

UNITED STATES OF AMERICA:
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

NOVEMBER, 1886.

PREPARED UNDER THE DIRECTION OF
BRIG. & BVT. MAJ. GEN'L W. B. HAZEN,
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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of November, 1886.

Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.
Alcoa Line.		National Line.		Miscellaneous—Con.	
Br. s. s. <i>Arcton</i>	Capt. C. E. Le Gallais.	Br. s. s. <i>Canada</i>	Capt. Thos. Foots.	Span. <i>Fitzroy</i>	Capt. Henry Gibb.
Sardinian	W. H. Smith.	Denmark	R. S. Rigby.	Am. <i>Hugo</i>	A. de Magica.
Scandinavian	John Park.	Egypt	J. Sumner.	Nor. <i>Lorenzo D. Baker</i>	Warren F. Wiley.
American Line.		England	T. P. Healey.	Br. <i>Ludvig Holberg</i>	N. Hooge.
Br. s. s. <i>British King</i>	John Kelly.	Erie	J. Robinson.	Br. <i>Madrid</i>	M. Garson.
Lord Clive	F. Urquhart.	France	A. D. Hadley.	Span. <i>Matthew Bedlington</i>	Thomas Kirby.
Lord Gough	E. M. Hughes.	Greece	A. Jeffrey.	Br. <i>Navarro</i>	S. de Aldecoa.
Anchor Line.		Helvetia	G. Ochrane.	Span. <i>Ocean Prince</i>	W. J. Milburn.
Br. s. s. <i>Acadia</i>	C. W. Haynes.	Holland	W. Tyson.	Br. <i>Manuel L. Villaverde</i>	Claudio Perales.
Bohria	J. J. Small.	Italy	W. Pearce.	Br. <i>Rover</i>	Jas. Mansfield.
British Crown	Archibald Smith.	Navigazione Generale Italiana.		Br. <i>Salisbury</i>	W. Durham.
British Queen	R. Wills.	It. s. s. <i>Independente</i>	P. Pirandello.	Span. <i>Saint Roman</i>	Henry Campbell.
Circus	A. Campbell.	Polcevera	Droghda.	Br. <i>Sets</i>	F. de Larraga.
Devonia	Hugh Young.	New York and Cuba Mail S. S. Co.		Br. <i>Yedimondale</i>	B. W. Rick.
Dorian	J. McKean.	Am. s. s. <i>Cienfuegos</i>	F. M. Faircloth.	New York Herald Weather Service.	
Ethiopia	John Wilson.	N. Y. <i>Havana & Mexican Mail S. S. Co.</i>		Am. s. s. <i>Acapulco</i>	C. F. Coyle.
Anglo-American Steamship Co.		Am. s. s. <i>City of Alexandria</i>	J. W. Reynolds.	Br. s. s. <i>Athena</i>	Siders.
Br. s. s. <i>Port Phillip</i>	Geo. Dulling.	City of Washington	W. M. Rittig.	Am. <i>Athos</i>	Low.
Atlas Line.		North German Lloyd Steamship Co.		Br. <i>Barracuta</i>	H. Bernpohl.
Br. s. s. <i>Alma</i>	J. W. Benson.	Ger. s. s. <i>Aller</i>	F. Hamelmann.	Am. <i>Barraco</i>	W. Rea.
Andes	T. M. McKnight.	America	H. Budeker.	Br. <i>Buffalo</i>	J. H. Malet.
Smith's S. S. Co. (Limited).		Eider	H. Helmers.	Am. <i>Caracas</i>	W. M. Hopkins.
Br. s. s. <i>Clement</i>	Thomas Burley.	Elbe	H. Christoffers.	Br. <i>Chalmette</i>	J. B. Perry.
Jerome	Benj. Crimp.	Elba	T. Jungst.	Am. <i>City of Chester</i>	A. Lewis.
British City Line.		Fulda	H. Ring.	Br. <i>City of Richmond</i>	A. Bedford.
Br. s. s. <i>Brooklyn City</i>	W. Pitt.	Hermann	A. Kohlmann.	Am. <i>City of Paris</i>	L. F. Dexter.
Wells City	T. L. Weiss.	Main	H. Supper.	Br. <i>City of Puebla</i>	Dusken.
Cromwell Line.		Rhein	L. Johns.	Am. <i>Comal</i>	J. Bolger.
Br. s. s. <i>Hudson</i>	H. R. Freeman.	Saale	H. Reichter.	Br. <i>El Monte</i>	J. W. Hawthorne.
Louisiana	E. V. Gager.	Trave	W. Willigerod.	Am. <i>El Paso</i>	H. S. Quick.
Conard Line.		Werra	R. Busch.	Br. <i>Furness</i>	Hedderwick.
Br. s. s. <i>Antonia</i>	W. H. P. Hains.	Cornwall Steamship Company.		Am. <i>Lampasas</i>	M. B. Crowell.
Catalonia	Alex. McKay.	Am. s. s. <i>Chattahoochee</i>	J. W. Catharine.	Dich. <i>Leerdam</i>	Stredragt.
Etruria	T. Cook.	Old Dominion Steamship Company.		Br. <i>Llandaff City</i>	T. H. Gere.
Samaris	T. Roberts.	Am. s. s. <i>Manhattan</i>	Frank Stevens.	Am. <i>Lone Star</i>	Mason.
Servia	H. McKay.	Oregon Railway and Navigation Co.		Br. <i>Martello</i>	F. E. Jenkins.
Edward & Cur's S. S. Line.		Am. s. s. <i>Oregon</i>	E. Polmann.	Am. <i>Miranda</i>	E. Benson.
Br. s. s. <i>Amalfi</i>	Julius Bahr.	Pacific Coast Steamship Company.		Br. <i>Morgan City</i>	J. B. Percy.
Australia	G. Frank.	Am. s. s. <i>Orizaba</i>	C. M. Goodall.	Am. <i>Muriel</i>	G. S. Locke.
Tasmania	H. M. Franck.	Pacific Mail Steamship Company.		Br. <i>Newport</i>	W. G. Shackford.
Falmer Line.		Am. s. s. <i>Colon</i>	Chas. C. Lima.	Br. <i>Nigara</i>	G. V. Bemis.
Br. s. s. <i>Neustria</i>	F. Verrihre.	San Blas	Thos. Chapman.	Am. <i>Portia</i>	H. Dawson.
Farmer Line.		Quebec Steamship Company.		Br. <i>Republic</i>	J. F. Irving.
Br. s. s. <i>Bordeaux</i>	F. Manley.	Br. s. s. <i>Orinoco</i>	J. S. Garvin.	Am. <i>Rio Grande</i>	P. J. Lewis.
Durham City	M. P. Lund.	Trinidad	W. J. Fraser.	Br. <i>Sirius</i>	W. H. Stapleton.
General Trans-Atlantic Steamship Co.		Red "D" Line.		Am. <i>Spain</i>	W. A. Griffiths.
Br. s. s. <i>La Bourgogne</i>	H. Franguel.	Am. s. s. <i>Philadelphia</i>	Sam. Hens.	Br. <i>Umbria</i>	W. McKicken.
La Bretagne	M. de Jonasson.	Br. s. s. <i>Red Cross Line.</i>		Am. <i>Valencia</i>	W. Woodrick.
La Champagne	E. Traub.	Br. s. s. <i>Capulet</i>	W. H. Ellis.	Dich. <i>W. A. Scholten</i>	G. J. Vis.
La Gascogne	Santelli.	Red Star Line.		Br. <i>Abyssinian</i>	John Hughes.
La Normandie	G. de Kersabien.	Belg. s. s. <i>Belgenland</i>	W. A. Beynon.	Am. <i>Achash</i>	A. M. Shaw.
Great Western S. S. Line.		Nederland	A. J. Griffin.	Br. <i>Agostino Bombo</i>	Vincenzo Basso.
Br. s. s. <i>Dorset</i>	Ch. Off. H. Crossman.	Noordland	H. E. Nicks.	Am. <i>Arnold von Bippen</i>	T. Moller.
Warwick	Capt. W. Jones.	Pennland	H. D. Weyer.	Nor. <i>B. D. Metcalf</i>	E. P. Larsen.
Union Line.		Rhynland	J. C. Jamison.	Am. <i>Boston Marine</i>	H. V. Porter.
Br. s. s. <i>Arizona</i>	S. Brooks.	Switzerland	H. Buschmann.	Br. <i>British Isles</i>	G. Southcott.
Nevada	John Douglas.	Westernland	Com. W. G. Randle.	Ger. <i>Carl</i>	Hashagen.
Wisconsin	Edward Bentley.	Westernland Line.		Am. <i>Carib</i>	John Rome.
Wyoming	C. L. Rigby.	Dich. s. s. <i>Edam</i>	Capt. J. H. Tant.	Br. <i>Comet</i>	Ch. Off. A. P. Goodman.
Hambley American Line.		Schiedam	A. Potjer.	Am. <i>Don Justo</i>	Capt. N. A. Anderson.
Br. s. s. <i>Bohemia</i>	R. Kurlowa.	Regal Mail Steamship Co.		Ger. <i>Edward H. Emerson</i>	W. H. Aldrich.
Gallert	W. Kuhlwein.	Am. s. s. <i>City of Dallas</i>	C. W. Read.	Am. <i>Eliza Baras</i>	N. E. Shaffer.
Hungarian	H. Leithner.	State of Georgia	G. Moodie.	Br. <i>Eyrant</i>	A. H. Child.
Rhodia	H. Vogelwang.	State of Pennsylvania	A. J. A. Mann.	Am. <i>Frattola Lauren</i>	Henry H. Hollis.
Rugia	A. Albers.	State of Nebraska	A. G. Brues.	Br. <i>Friederike</i>	A. G. Nicolich.
Slavonia	H. Schmidt.	Thapsalia Line.		Am. <i>Harriet S. Jackson</i>	Lodovico Laurin.
Wieland	C. Hobich.	Dan. s. s. <i>Gelert</i>	C. W. Muller.	Ger. <i>Hedwig</i>	Th. Tiesken.
Westphalia	Druscher.	Hehla	A. G. Thomson.	Am. <i>Josephine</i>	C. Elensson.
Harrison Line.		Thingvall	S. T. H. Laub.	Br. <i>John S. Wood</i>	W. T. Bacon.
Br. s. s. <i>Comanitor</i>	Wm. Lang.	Twin River Line.		Dich. <i>Joak E. More</i>	Th. Minson.
Irwin Line.		Br. s. s. <i>Richmond Hill</i>	A. Hyde.	Am. <i>Leander</i>	T. T. Verbricht.
Br. s. s. <i>City of Berlin</i>	Francis S. Land.	Tower Hill.	F. Archer, R.N.R.	Nor. <i>Leander</i>	Chas. Brown.
City of Chicago	Fred Watkins.	Warren Line.		Am. <i>Leander</i>	Wm. S. Bernard.
Lumpert & Holt's Steamship Company.		Br. s. s. <i>Town</i>	Samuel Walters.	Ger. <i>Komander Svend Foyen</i>	Aamus Lenhard.
Br. s. s. <i>Holborn</i>	T. T. Farrell.	Norseman	E. Maddox.	Br. <i>Leander</i>	John Bryde.
Others	Jas. Clark.	Watte Ward Line.		Am. <i>Leander</i>	John Stobf.
Thales	Joe. Glaspeole.	Br. s. s. <i>Richmond</i>	J. Garson.	Br. <i>Lillian</i>	Geo. F. Gerry.
Lyons Line.		White Cross Line.		Am. <i>Lillian</i>	A. Alexander.
Br. s. s. <i>Bavarian</i>	R. Lusk.	Br. s. s. <i>De Ruyter</i>	J. J. Brarons.	Br. <i>Lizzie Carter</i>	H. F. Schive.
Bulgarian	E. Parry.	Jan Breydel	H. Meyer.	Am. <i>Maggie Abbott</i>	C. J. Carter.
Isorian	T. H. Fox.	Pieter de Coninck	E. Smil.	Br. <i>Mary Fink</i>	D. C. McIntosh.
Virginian	M. Pitt.	White Star Line.		Am. <i>Minnie G. Whitney</i>	D. F. Barrish.
Mallory Line.		Br. s. s. <i>Adriatic</i>	H. Parrell.	Ger. <i>Nellie M. Slade</i>	J. D. Foley.
Br. s. s. <i>Alamo</i>	S. Risk.	Britannic	H. Parry.	Am. <i>Orto</i>	F. G. Phipps.
Colorado	Jas. Daniels.	Gormanic	C. W. Kennedy.	Br. <i>Orto</i>	J. A. Gould.
Rio Grande	J. F. Lewis.	Wilson Line.		Am. <i>Orto</i>	W. Langen.
San Marcos	A. C. Burrows.	Br. s. s. <i>Galileo</i>	R. Potter.	Ger. <i>Orto</i>	Anderson.
Mediterranean & New York S. S. Co.		Miscellaneous.		Br. <i>Richard</i>	John B. Zimmer.
Br. s. s. <i>Pontiac</i>	Ch. Off. R. Blyth.	Br. s. s. <i>Angerton</i>	S. M. Orr.	Am. <i>Rosebud</i>	A. von Eggers.
Mis. & Dominion S. S. Co.		Athens	Ch. Off. Emil Towns.	Br. <i>Teneriff</i>	John Colie.
Br. s. s. <i>Montreal</i>	Capt. F. Bouchettes.	Amicthia	Capt. P. M. Heims.	Am. <i>Teresa Acame</i>	W. S. Richardson.
Toronto	Jas. McAuley.	Bedford	T. Aitkenhead.	Ger. <i>Union</i>	Grolamo Hostio.
Monarch Line.		Cranbrook	John W. Harvey.	Br. <i>Victoria</i>	H. Fokken.
Br. s. s. <i>Amyrias Monarch</i>	John Harrison.	Edith Gordon	John H. Bennett.	Am. <i>Water Witch</i>	B. F. Rehm.
Lylian Monarch	T. C. Huggett.	El Callao	Joseph Scholts.	Br. <i>Water Witch</i>	Max Knaebel.
Morgan Line.		Elstow	T. Robertson.	Am. <i>Light-ship No. 37</i>	A. J. Biddle.
Br. s. s. <i>Karna</i>	R. B. Quick.	Span. <i>Emiliano</i>	F. de Bengos.		Andrew Jackson.

MONTHLY WEATHER REVIEW.

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INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during November, 1886, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. In tracing the centres of the paths of these storms, data from the reports of one hundred and eighty-five vessels have been used.

With the exception of one iceberg, observed on the 2d, no ocean ice has been reported in the vicinity of the trans-Atlantic ship routes.

On chart i for this month are traced the paths of fourteen areas of low pressure; the average number for November during the last fourteen years being 11.7. That described as number vii was the severest storm of the month, and caused, in connection with the succeeding area of high pressure, meteorological disturbances over the greater part of the country east of the Rocky Mountains; the gales on the Lakes, and high winds with snow in the Missouri and upper Mississippi valleys, were especially severe.

The mean pressure for the month is normal, or nearly so, over the eastern slope of the Rocky Mountains; from this region eastward it is generally below the normal; along the Pacific coast it is considerably above the normal.

The month has been colder than the average November in all districts of the United States, except New England, the middle Atlantic states, and North Carolina.

The precipitation is very small on the Pacific slope and in the south Atlantic and Gulf states; in the other districts it presents no great departures from the normal.

In this REVIEW, under "Notes and extracts," will be found an instructive paper by Prof. Cleveland Abbe, Assistant, on "The effects of wind and exposure upon barometric readings;" also a paper by Private I. M. Cline, Signal Service observer at Abilene, Texas, on "Rainfall and its source in the southern slope;" and an article by Dr. H. B. Baker, secretary of the Michigan State Board of Health, containing a short discussion of the relations existing between dry and cold air and the causes of pneumonia.

In the preparation of this REVIEW the following data, received up to December 20, 1886, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty Canadian stations, as telegraphed to this office; one hundred and sixty-two monthly journals; one hundred and fifty-six monthly means from the former, and twenty monthly means from the latter; two hundred and sixty-nine monthly registers from voluntary

observers; fifty-four monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Indiana, Illinois, Iowa, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, Ohio, and Tennessee; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean pressure for November, 1886, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

An examination of the chart will show that the mean atmospheric pressure over the United States during the month is greatest in Washington Territory, Oregon, Nevada, Utah, and northern California, where it ranges from 30.16 at Tatoosh Island, Washington Territory, to 30.31, the highest mean pressure of the month, at Fort Bidwell, California, and averages about 30.24. The area of minimum pressure covers Maine, New Hampshire, Vermont, northern New York, and the upper lake region; within this area the pressure ranges from 29.89 at Mount Washington, New Hampshire, to 29.93 at several stations on the upper lakes, and averages about 29.92. Southward of the isobar of 29.95, which extends almost directly east and west through the centre of New England, New York, and the Lakes, the pressure increases steadily at the rate of about .05 to each three degrees of latitude until the pressure of 30.13 is attained along the Gulf coast.

The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. The mean pressure when compared with the normal will be found deficient, except in Florida and a narrow strip along the Gulf coast, over the eastern half of the country, and excessive in the western half, with the exception of Dakota and eastern Montana where it is normal or slightly below. The largest departures below the normal occur in New England, New York, Pennsylvania, and Maryland, where they range from .14 at New London, Connecticut, to .10 at several stations; in the south Atlantic and Gulf states the pressure exhibits only slight departures from the normal. In the Rocky Mountain regions and along the Pacific coast the pressure of the month is considerably above the normal, the largest departures occurring in Washington Territory and Oregon, where they average about .16. At two stations, Tatoosh Island and Fort Canby, Washington Territory, the unusually large departure of .23 occurs; this is partially owing to the short record from which the normal at these stations is deduced; all stations in California show an increase of .07.

When compared with the mean pressure of the preceding month, October, 1886, a very large decrease is noted in the portion of country lying north of the thirty-fifth parallel and east of the Mississippi River, the deficiency in New England and the Lake region is especially large, the departures ranging from .17 to .27. In the Rocky Mountain regions and along the Pacific coast the increase is equally as large, the

pressure at Salt Lake City, Utah, and Winnemucca, Nevada, being, respectively, .27 and .24 above that of last month; along the Pacific coast the increase averages about .15.

The mean pressure for November, 1886, as compared with that of November, 1885, exhibits some noteworthy features, especially over the north Pacific coast region; in November, 1885, this was the region of minimum pressure, the barometric means ranging from 29.95 in the interior to 29.75 on the coast, this month it is the region of maximum pressure, the barometric means averaging about 30.24.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are given in the table of miscellaneous data. The following are some of the extreme monthly ranges:

Greatest.		Least.	
	Inch.		Inch.
Salt Lake City, Utah.....	1.57	Key West, Florida.....	0.36
Mount Washington, New Hampshire.....	1.55	Sacramento, California.....	0.36
Huron, Dakota.....	1.49	Sanford, Florida.....	0.39
Moorhead, Minnesota.....	1.47	Cedar Keys, Florida.....	0.44
Fort Bridger, Wyoming.....	1.46	Jacksonville, Florida.....	0.47
Marquette, Michigan.....	1.43	San Diego, California.....	0.49
Pike's Peak, Colorado.....	1.40	Charleston, South Carolina.....	0.54
Montrose, Colorado.....	1.38	Savannah, Georgia.....	0.56

AREAS OF HIGH PRESSURE.

[Prepared by Lieut. JOHN P. FINLEY, Signal Corps, U. S. Army, Assistant.]

In discussing areas of high pressure for November, 1886, it has appeared advisable to change somewhat the usual method of describing them, having in view the twofold purpose of condensing the information and directing attention only to the salient points exhibited by each area during its progress eastward within the limits of observation.

In order to accomplish this scheme the information at hand has been systematically arranged, as shown in the accompanying table. That the designations employed may be clearly understood, the following explanations are deemed necessary:

The times 7 a. m., 3 p. m., and 10 p. m. are the hours (75th meridian time) at which the tri-daily telegraphic meteorological observations are made at Signal Service stations. These observations are used in the preparation of the daily weather maps from which indications are made, and from a study of which the tracks of high pressure areas are charted and described.

Barometric departure refers to the maximum deviation of pressure from the normal within the central area, which deviation in all cases will have the plus sign.

Temperature departure refers to the maximum deviation of temperature from the normal within the central area, which deviation in all cases will have the minus sign.

The location of the maximum deviation of temperature was almost invariably found several hundred miles in advance, to the south and east, of the region of highest barometer. Similar to the extension eastward of the area of precipitation in advance of the central area of lowest pressure, so appeared the influence of the high pressure area upon the fall of temperature, carrying the cold wave frequently far in advance of the region of barometric maxima.

It is important to note the varying intensity of each high pressure area as shown by the barometric departures during its progressive movement to the eastward, and also the relation of these changes to the fluctuations in temperature departures.

Eleven areas of high pressure appeared within the limits of the Signal Service charts for the month of November, 1886. The majority of these areas made their first appearance in the Pacific coast states, north of parallel 37° N.

Areas numbers i, iii, v, and xi were particularly sluggish in their progressive movement.

Area number viii possessed the highest velocity of translation.

Table of high pressure areas.

Number of area.	Date.	Hour of observation.	Location of central storm area.	Barometer departure.	Temperature departure.	Remarks.
				Inches.	°	
I.....	1	7 a. m.	Northern California.....	+0.16	-8	This area merged during the day with No. III which entered Washington Territory on the 4th.
		3 p. m.	Northern Nevada.....	+0.18	-15	
		10 p. m.	do.....	+0.17	-14	
2	2	7 a. m.	do.....	+0.22	-9	
		3 p. m.	do.....	+0.26	-1	
		10 p. m.	Northern Utah.....	+0.29	-4	
3	3	7 a. m.	do.....	+0.34	-3	
		3 p. m.	Central Utah.....	+0.29	-4	
		10 p. m.	Northern Nevada.....	+0.23	-2	
II.....	4	7 a. m.	do.....	+0.20	-8	
		3 p. m.	West Washington Ter.....	+0.51	-2	
		10 p. m.	Central Washington Ter.....	+0.35	-5	
5	5	7 a. m.	West Montana.....	+0.50	-7	
		3 p. m.	Southwest Montana.....	+0.48	-8	
		10 p. m.	West Nebraska.....	+0.43	-7	
6	6	7 a. m.	West Kansas.....	+0.42	-14	This area remained stationary for two days off the south Atlantic coast and then disappeared eastward over the ocean.
		3 p. m.	Indian Territory.....	+0.33	-18	
		10 p. m.	do.....	+0.24	-11	
7	7	7 a. m.	Northeast Texas.....	+0.24	-17	
		3 p. m.	Central Texas.....	+0.21	-20	
		10 p. m.	Southern Texas.....	+0.18	-11	
8	8	7 a. m.	West Tennessee.....	+0.14	-18	
		3 p. m.	Northern Georgia.....	+0.13	-14	
		10 p. m.	Coast of South Carolina.....	+0.16	-17	
III.....	9	3 p. m.	West Washington Ter.....	+0.35	-12	
		10 p. m.	Northwest Montana.....	+0.26	-12	
		20	7 a. m.	Northwest Dakota.....	+0.36	-15
10	10	3 p. m.	Central Dakota.....	+0.40	-25	
		10 p. m.	Southeast Dakota.....	+0.41	-19	
		11	7 a. m.	East Minnesota.....	+0.41	-14
11	11	3 p. m.	Northwest Wisconsin.....	+0.40	-7	This area disappeared over northern Canada.
		10 p. m.	Northern Wisconsin.....	+0.39	-6	
		12	7 a. m.	do.....	+0.41	-9
IV.....	11	3 p. m.	Lake Superior.....	+0.33	-14	
		7 a. m.	Northern Utah.....	+0.38	-16	
		3 p. m.	do.....	+0.37	-24	
12	12	7 a. m.	Western Colorado.....	+0.35	-19	
		10 p. m.	do.....	+0.34	-24	
		3 p. m.	do.....	+0.31	-27	
13	13	10 p. m.	Indian Territory.....	+0.36	-15	This area merged with No. VI, central in Iowa, on the morning of the 15th.
		7 a. m.	Arkansas.....	+0.27	-19	
		3 p. m.	Southern Missouri.....	+0.32	-18	
14	14	10 p. m.	Southern Arkansas.....	+0.27	-13	
		7 a. m.	Northern Alabama.....	+0.30	-18	
		3 p. m.	do.....	+0.28	-15	
V.....	13	10 p. m.	Mississippi.....	+0.25	-11	
		7 a. m.	West Washington Ter.....	+0.41	-12	
		3 p. m.	Northern Oregon.....	+0.44	-10	
14	14	10 p. m.	do.....	+0.48	-9	
		7 a. m.	Washington Territory.....	+0.68	-8	
		3 p. m.	do.....	+0.72	-11	
15	15	10 p. m.	do.....	+0.75	-15	This area disappeared northward in British America.
		7 a. m.	do.....	+0.76	-16	
		3 p. m.	do.....	+0.64	-25	
16	16	10 p. m.	Northwest Montana.....	+0.68	-19	
		7 a. m.	Central Montana.....	+0.57	-25	
		3 p. m.	do.....	+0.41	-33	
VI.....	17	10 p. m.	West Dakota.....	+0.35	-31	
		7 a. m.	Northeast Dakota.....	+0.37	-26	
		15	7 a. m.	Iowa.....	+0.44	-8
18	18	3 p. m.	Northern Illinois.....	+0.42	-3	
		10 p. m.	Southern Michigan.....	+0.39	-11	
		16	7 a. m.	Lower Canada.....	+0.45	-18
19	19	3 p. m.	Southern New York.....	+0.40	-10	This area disappeared eastward over the Atlantic during the day.
		10 p. m.	Massachusetts.....	+0.37	-11	
		7 a. m.	Nova Scotia.....	+0.33	-9	
VII.....	17	3 p. m.	New Brunswick.....	+0.29	-11	
		10 p. m.	Gulf of Saint Lawrence.....	+0.24	-6	
		18	7 a. m.	Southern Texas.....	+0.29	-24
20	20	7 a. m.	do.....	+0.35	-26	
		3 p. m.	Texas coast.....	+0.31	-16	
		10 p. m.	Coast of Louisiana.....	+0.28	-23	
VIII.....	19	7 a. m.	Southern Mississippi.....	+0.30	-21	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Southern Alabama.....	+0.29	-11	
		10 p. m.	do.....	+0.21	-12	
21	21	7 a. m.	Southern Georgia.....	+0.16	-17	
		3 p. m.	East coast of Florida.....	+0.16	-6	
		22	7 a. m.	Manitoba.....	+0.23	-14
IX.....	23	7 a. m.	Lake Superior.....	+0.29	-15	This area disappeared eastward over the Atlantic.
		3 p. m.	East of Lake Huron.....	+0.26	-7	
		10 p. m.	Vermont.....	+0.21	-8	
X.....	23	7 a. m.	Nova Scotia.....	+0.20	-12	
		3 p. m.	Northern California.....	+0.24	-6	
		10 p. m.	do.....	+0.22	-17	
24	24	7 a. m.	Southern Oregon.....	+0.36	-16	This area merged with No. X, central in Nevada.
		3 p. m.	Northern Utah.....	+0.22	-23	
		10 p. m.	do.....	+0.32	-26	
XI.....	25	7 a. m.	Western Colorado.....	+0.39	-20	
		3 p. m.	Nevada.....	+0.26	-19	
		10 p. m.	Central Utah.....	+0.32	-20	
26	26	7 a. m.	Central Colorado.....	+0.49	-17	This area disappeared eastward over the Atlantic during the day.
		3 p. m.	Central Kansas.....	+0.50	-20	
		10 p. m.	Southern Missouri.....	+0.45	-18	
27	27	7 a. m.	Kentucky.....	+0.39	-19	
		3 p. m.	Southwestern Virginia.....	+0.31	-14	
		10 p. m.	Southeast Virginia.....	+0.19	-13	
28	28	7 a. m.	Southern Utah.....	+0.52	-17	
		3 p. m.	do.....	+0.50	-18	
		10 p. m.	do.....	+0.56	-13	
29	29	7 a. m.	do.....	+0.54	-16	
		3 p. m.	do.....	+0.49	-15	
		10 p. m.	do.....	+0.47	-11	

Table of high pressure areas—Continued.

Number of area.	Date.	Hour of observation.	Location of central storm area.	Barometer departure.	Temperature departure.	Remarks.
XI.....	28	3 p. m.	Central Utah.....	+0.46	-12	A further consideration of this area will appear in the REVIEW for December, 1886.
		10 p. m.	.....do.....	+0.37	-13
	29	7 a. m.	.....do.....	+0.32	-17
		3 p. m.	.....do.....	+0.33	-8
		10 p. m.	Northern Nevada.....	+0.20	-9	
	30	7 a. m.	Southern Montana.....	+0.09	-9	
		3 p. m.	Western Dakota.....	+0.21	-37	
		10 p. m.	.....do.....	+0.37	-39

AREAS OF LOW PRESSURE.

[Prepared by Lieut. JOHN P. FINLEY, Signal Corps, U. S. Army, Assistant.]

The following table shows the latitude and longitude in which each area of low pressure was first and last observed, with the average rate of translation in miles per hour:

Areas of low pressure.	First observed.		Last observed.		Average velocity of translation in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.....	37 00	107 00	48 00	62 00	23.0
II.....	51 00	112 00	50 00	70 00	33.0
III.....	39 00	81 00	50 00	62 00	15.0
IV.....	51 00	107 00	49 00	70 00	21.0
V.....	41 00	110 00	50 00	59 00	19.0
VI.....	52 00	112 00	50 00	67 00	22.0
VII.....	40 00	116 00	49 00	62 00	24.0
VIII.....	40 00	78 00	50 00	58 00	26.0
IX.....	49 00	122 00	50 00	62 00	27.0
X.....	31 00	103 00	48 00	65 00	20.0
XI.....	51 00	117 00	41 00	99 00	28.0
XII.....	51 00	109 00	50 00	67 00	33.0
XIII.....	50 00	113 00	41 00	71 00	33.0
XIV.....	51 00	108 00	49 00	85 00	39.0

Average rate of movement, 25.2 miles per hour.

In discussing areas of low pressure for November, 1886, it has been deemed advisable to depart somewhat from the usual method heretofore pursued in the presentation of this subject, and invite attention to certain important and interesting changes which characterize the storm at each hour of observation during its progress eastward within the limits of the Signal Service charts.

Among the many phenomena which attend, and are peculiar to barometric depressions, none are more valuable for examination and study than precipitation and the variability of storm-energy.

In order that the text may be clearly understood, the following explanations are deemed necessary:

The times 7 a. m., 3 p. m., and 10 p. m. are the hours (75th meridian time) at which the tri-daily telegraphic meteorological observations are made at Signal Service stations. These observations are used in the preparation of the daily weather maps from which indications are made, and from a study of which the tracks of low-pressure areas are charted and described.

The word "departure" refers to the maximum departure of the barometer from the normal within the central area of low pressure.

The word "position" refers to the region covered by the central storm-area.

The word "precipitation" refers to all rain or snow that has fallen during the past eight hours, or since the last observation. In order to show, approximately, the distribution of precipitation about the central area of low pressure, the four quadrants of the depression are separately considered by designating the number of stations in each at which precipitation has taken place.

It is important to note the variability of energy manifested by each depression, as shown by the barometric departures from the normal, during its progressive movement to the eastward, and also the relation of these changes to the position and extent of the region of precipitation.

The tracks of fourteen areas of low pressure have been charted from a study of the tri-daily weather charts of the Signal Service for the month of November, 1886. Considering their first appearance, there seems to have been two regions of development, one in the Saskatchewan Valley of British North America, and the other in the southern plateau, which embraces the state of Colorado and the territories of Arizona, New Mexico, and Utah. The majority of the disturbances first appeared in the former region, and passed thence eastward over the Lakes to the Canadian Maritime Provinces, beyond which their further course lies without the limits of the daily weather map.

I.—1st, 7 a. m. Position, *southeast Colorado*: Departure, —.52 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, none; sw. quadrant, none; nw. quadrant, two stations.

3 p. m. Position, *southwest Nebraska*: Departure, —.59 inch. Precipitation, ne. quadrant, three stations; se. quadrant, none; sw. quadrant, two stations; nw. quadrant, five stations.

10 p. m. Position, *southeast Dakota*: Departure, —.59 inch. Precipitation, ne. quadrant, none; se. quadrant, one station; sw. quadrant, six stations; nw. quadrant, two stations.

2d, 7 a. m. Position, *southwest Minnesota*: Departure, —.66 inch. Precipitation, ne. quadrant, three stations; se. quadrant, none; sw. quadrant, two stations; nw. quadrant, two stations.

3 p. m. Position, *northern Minnesota*: Departure, —.68 inch. Precipitation, ne. quadrant, none; se. quadrant, two stations; sw. quadrant, three stations; nw. quadrant, one station.

10 p. m. Position, *north of Lake Superior*: Departure, —.64 inch. Precipitation, ne. quadrant, none; se. quadrant, five stations; sw. quadrant, three stations; nw. quadrant, none.

3d, 7 a. m. Position, *northeast of Lake Superior*: Departure, —.48 inch. Precipitation, ne. quadrant, none; se. quadrant, four stations; sw. quadrant, five stations; nw. quadrant, one station.

3 p. m. Position, *northern Canada*: Departure, —.42 inch. Precipitation, ne. quadrant, no reports; se. quadrant, none; sw. quadrant, nine stations; nw. quadrant, none.

10 p. m. Position, *northern Canada*: Departure, —.35 inch. Precipitation, ne. quadrant, none; se. quadrant, none; sw. quadrant, nine stations; nw. quadrant, two stations.

4th, 7 a. m. Position, *northeast Canada*: Departure, —.33 inch. Precipitation, ne. quadrant, no reports; se. quadrant, none; sw. quadrant, eight stations; nw. quadrant, none.

3 p. m. Position, *mouth of Saint Lawrence River*: Departure, —.31 inch. Precipitation, ne. quadrant, none; se. quadrant, none; sw. quadrant, five stations; nw. quadrant, none.

10 p. m. Position, *Gulf of Saint Lawrence*: Departure, —.23 inch. Precipitation, ne. quadrant, no reports; se. quadrant, three stations; sw. quadrant, 1 station; nw. quadrant, no reports. From this region the depression moved thence eastward to the Atlantic.

II.—3d, 3 p. m. Position, *Saskatchewan Valley*: Departure, —.30 inch. Precipitation, in all quadrants, none.

10 p. m. Position, *Saskatchewan Valley*: Departure, —.45 inch. Precipitation, in all quadrants, none.

4th, 7 a. m. Position, *Manitoba*: Departure, —.80 inch. Precipitation, in all quadrants, none.

3 p. m. Position, *north of Minnesota*: Departure, —.71 inch. Precipitation, ne. quadrant, one station; se. quadrant, none; sw. quadrant, none; nw. quadrant, one station.

10 p. m. Position, *north coast of Lake Superior*: Departure, —.53 inch. Precipitation, ne. quadrant, no reports; se. quadrant, none; sw. quadrant, none; nw. quadrant, six stations.

5th, 7 a. m. Position, *north of Lake Huron*: Departure, —.35 inch. Precipitation, ne. quadrant, no reports; se. quadrant, none; sw. quadrant, two stations; nw. quadrant, four stations.

3 p. m. Position, *northern Canada*: Departure, —.18 inch. Precipitation, ne. quadrant, none; se. quadrant, none; sw. quadrant, two stations; nw. quadrant, two stations.

10 p. m. Position, *mouth of Saint Lawrence River*: Depart-

ure, —.09 inch. Precipitation, in all quadrants, none. From this region the depression moved thence eastward to the Atlantic.

III.—6th, 7 a. m. Position, *northern Virginia*: Departure, —.25 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, none; sw. quadrant, thirteen stations; nw. quadrant, seven stations.

3 p. m. Position, *eastern Pennsylvania*: Departure, —.31 inch. Precipitation, ne. quadrant, six stations; se. quadrant, no reports; sw. quadrant, eighteen stations; nw. quadrant, fourteen stations.

10 p. m. Position, *Connecticut*: Departure, —.46 inch. Precipitation, ne. quadrant, ten stations; se. quadrant, no reports; sw. quadrant, seventeen stations; nw. quadrant, fifteen stations.

7th, 7 a. m. Position, *coast of Maine*: Departure, —.93 inch. Precipitation, ne. quadrant, two stations; se. quadrant, no reports; sw. quadrant, twenty stations; nw. quadrant, five stations.

3 p. m. Position, *northern Maine*: Departure, —.93 inch. Precipitation, ne. quadrant, no reports; se. quadrant, one station; sw. quadrant, thirteen stations; nw. quadrant, two stations.

10 p. m. Position, *lower Saint Lawrence valley*: Departure, —.61 inch. Precipitation, ne. quadrant, two stations; se. quadrant, three stations; sw. quadrant, twelve stations; nw. quadrant, no reports.

8th, 7 a. m. Position, *mouth of Saint Lawrence River*: Departure, —.51 inch. Precipitation, ne. quadrant, two stations; se. quadrant, one station; sw. quadrant, nine stations; nw. quadrant, no reports.

3 p. m. Position, *Gulf of Saint Lawrence*: Departure, —.40 inch. Precipitation, ne. quadrant, no reports; se. quadrant, one station; sw. quadrant, nine stations. From this region the depression moved thence eastward to the Atlantic.

IV.—7th, 3 p. m. Position, *Saskatchewan Valley*: Departure, —.15 inch. Precipitation, in all quadrants, none.

10 p. m. Position, *Saskatchewan Valley*: Departure, —.25 inch. Precipitation, in all quadrants, none.

8th, 7 a. m. Position, *Manitoba*: Departure, —.42 inch. Precipitation, ne. and se. quadrants, none; sw. quadrant, two stations; nw. quadrant, none.

3 p. m. Position, *Manitoba*: Departure, —.48 inch. Precipitation, ne. quadrant, none; se. quadrant, four stations; sw. quadrant, three stations; nw. quadrant, none.

10 p. m. Position, *Manitoba*: Departure, —.57 inch. Precipitation, ne. quadrant, none; se. quadrant, seven stations; sw. quadrant, two stations; nw. quadrant, four stations.

9th, 7 a. m. Position, *northern Minnesota*: Departure, —.49 inch. Precipitation, ne. quadrant, none; se. quadrant, twenty stations; sw. quadrant, one station; nw. quadrant, five stations.

3 p. m. Position, *northern Wisconsin*: Departure, —.35 inch. Precipitation, ne. quadrant, three stations; se. quadrant, twenty-nine stations; sw. quadrant, three stations; nw. quadrant, six stations.

10 p. m. Position, *Lake Superior*: Departure, —.24 inch. Precipitation, ne. quadrant, no reports; se. quadrant, twenty-eight stations; sw. quadrant, seven stations; nw. quadrant, one station.

10th, 7 a. m. Position, *north of Lake Huron*: Departure, —.12 inch. Precipitation, ne. quadrant, two stations; se. quadrant, twenty-one stations; sw. quadrant, twelve stations; nw. quadrant, two stations.

3 p. m. Position, *Lower Canada*: Departure, —.12 inch. Precipitation, ne. quadrant, four stations; se. quadrant, ten stations; sw. quadrant, twenty-two stations; nw. quadrant, five stations.

10 p. m. Position, *Upper Canada*: Departure, —.05 inch. Precipitation, ne. quadrant, four stations; se. quadrant, seven stations; sw. quadrant, seventeen stations; nw. quadrant, no reports.

11th, 7 a. m. Position, *mouth of Saint Lawrence River*: Departure, —.01 inch. Precipitation, ne. quadrant, two stations; se. quadrant, three stations; sw. quadrant, eighteen stations; nw. quadrant, no reports. From this region the depression probably moved thence eastward to the Atlantic north of the Gulf of Saint Lawrence.

V.—9th, 3 p. m. Position, *northern Colorado*: Departure, —.24 inch. Precipitation, ne. quadrant, four stations; se. quadrant, none; sw. quadrant, none; nw. quadrant, four stations.

10 p. m. Position, *southern Colorado*: Departure, —.18 inch. Precipitation, ne. quadrant, one station; se. quadrant, none; sw. quadrant, none; nw. quadrant, four stations.

10th, 7 a. m. Position, *northwest Texas*: Departure, —.16 inch. Precipitation, ne. quadrant, none; se. quadrant, one station; sw. quadrant, none; nw. quadrant, four stations.

3 p. m. Position, *west Texas*: Departure, —.07 inch. Precipitation, ne. quadrant, none; se. quadrant, none; sw. quadrant, none; nw. quadrant, five stations.

10 p. m. Position, *southwest Texas*: Departure, —.12 inch. Precipitation, ne., se., and sw. quadrants, none; nw. quadrant, five stations.

11th, 7 a. m. Position, *central Texas*: Departure, —.14 inch. Precipitation, ne. quadrant, four stations; se. quadrant, one station; sw. quadrant, none; nw. quadrant, three stations.

3 p. m. Position, *Louisiana*: Departure, —.17 inch. Precipitation, ne. quadrant, five stations; se. quadrant, five stations; sw. quadrant, one station; nw. quadrant, three stations.

10 p. m. Position, *Mississippi*: Departure, —.21 inch. Precipitation, ne. quadrant, six stations; se. quadrant, five stations; sw. quadrant, six stations; nw. quadrant, six stations.

12th, 7 a. m. Position, *Tennessee*: Departure, —.42 inch. Precipitation, ne. quadrant, thirteen stations; southeast quadrant, nine stations; southwest quadrant, ten stations; nw. quadrant, four stations.

3 p. m. Position, *southwest Virginia*: Departure, —.48 inch. Precipitation, ne. quadrant, eleven stations; se. quadrant, five stations; sw. quadrant, eleven stations; nw. quadrant, six stations.

10 p. m. Position, *Maryland*: Departure, —.64 inch. Precipitation, ne. quadrant, ten stations; se. quadrant, one station; sw. quadrant, eight stations; nw. quadrant, seven stations.

13th, 7 a. m. Position, *off Long Island*: Departure, —.68 inch. Precipitation, ne. quadrant, ten stations; se. quadrant, no reports; sw. quadrant, twelve stations; nw. quadrant, nine stations.

3 p. m. Position, *off Massachusetts coast*: Departure, —.73 inch. Precipitation, ne. quadrant, six stations; se. quadrant, no reports; sw. quadrant, four stations; nw. quadrant, twelve stations.

10 p. m. Position, *off Maine coast*: Departure, —.82 inch. Precipitation, ne. quadrant, four stations; se. quadrant, no reports; sw. quadrant, nine stations; nw. quadrant, four stations.

14th, 7 a. m. Position, *New Brunswick*: Departure, —.82 inch. Precipitation, ne. quadrant, two stations; se. quadrant, two stations; sw. quadrant, four stations; nw. quadrant, two stations.

3 p. m. Position, *Gulf of Saint Lawrence*: Departure, —.89 inch. Precipitation, ne. quadrant, none; se. quadrant, two stations; sw. quadrant, five stations; nw. quadrant, no reports.

10 p. m. Position, *Gulf of Saint Lawrence*: Departure, —.74 inch. Precipitation, ne. quadrant, none; se. quadrant, one station; sw. quadrant, three stations; nw. quadrant, no reports. From this region the depression moved thence eastward to the Atlantic.

VI.—12th, 7 a. m. Position, *Saskatchewan Valley*: Departure, not given. Precipitation, ne., se., and nw. quadrants, none; sw. quadrant, three stations.

3 p. m. Position, *Saskatchewan Valley*: Departure, —.15 inch. Precipitation, in all quadrants, none.

10 p. m. Position, *Saskatchewan Valley*: Departure, —.19 inch. Precipitation, in all quadrants, none.

13th, 7 a. m. Position, *Manitoba*: Departure, —.18 inch. Precipitation, in all quadrants, none.

3 p. m. Position, *north of Minnesota*: Departure, —.19 inch. Precipitation, in all quadrants, none.

10 p. m. Position, *north of Lake Superior*: Departure, —.06 inch. Precipitation, in all quadrants, none. From this region the depression passed beyond the limits of the Signal Service charts.

VII.—14th, 10 p. m. Position, *Utah*: Departure, —.09 inch. Precipitation, ne. quadrant, two stations; se. quadrant, none; sw. quadrant, none; nw. quadrant, two stations.

15th, 7 a. m. Position, *northern Arizona*: Departure, —.22 inch. Precipitation, ne. quadrant, two stations; se. quadrant, three stations; sw. quadrant, none; nw. quadrant, two stations.

3 p. m. Position, *New Mexico*: Departure, —.31 inch. Precipitation, ne. quadrant, four stations; se. quadrant, three stations; sw. quadrant, none; nw. quadrant, four stations.

10 p. m. Position, *New Mexico*: Departure, —.50 inch. Precipitation, ne. quadrant, eight stations; se. quadrant, one station; sw. quadrant, none; nw. quadrant, twelve stations.

16th, 7 a. m. Position, *Indian Territory*: Departure, —.40 inch. Precipitation, ne. quadrant, five stations; se. quadrant, six stations; sw. quadrant, three stations; nw. quadrant, seven stations.

3 p. m. Position, *southwest Kansas*: Departure, —.43 inch. Precipitation, ne. quadrant, eight stations; se. quadrant, seven stations; sw. quadrant, four stations; nw. quadrant, eight stations.

10 p. m. Position, *northern Missouri*: Departure, —.63 inch. Precipitation, ne. quadrant, thirteen stations; se. quadrant, fifteen stations; sw. quadrant, six stations; nw. quadrant, five stations.

17th, 7 a. m. Position, *central Iowa*: Departure, —.77 inch. Precipitation, ne. quadrant, seventeen stations; se. quadrant, twenty-eight stations; sw. quadrant, eight stations; nw. quadrant, one station.

3 p. m. Position, *southern Wisconsin*: Departure, —.79 inch. Precipitation, ne. quadrant, twenty-eight stations; se. quadrant, twenty-five stations; sw. quadrant, six stations; nw. quadrant, eight stations.

10 p. m. Position, *northeast Wisconsin*: Departure, —.83 inch. Precipitation, ne. quadrant, twelve stations; se. quadrant, thirty-five stations; sw. quadrant, eleven stations; nw. quadrant, six stations.

18th, 7 a. m. Position, *north of Lake Huron*: Departure, —1.02 inches. Precipitation, ne. quadrant, no reports; se. quadrant, forty stations; sw. quadrant, thirteen stations; nw. quadrant, four stations.

3 p. m. Position, *north of Lake Huron*: Departure, —.88 inch. Precipitation, ne. quadrant, four stations; se. quadrant, thirty-one stations; sw. quadrant, thirteen stations; nw. quadrant, three stations.

10 p. m. Position, *northeast of Lake Huron*: Departure, —.68 inch. Precipitation, ne. quadrant, none; se. quadrant, eight stations; sw. quadrant, eleven stations; nw. quadrant, six stations.

19th, 7 a. m. Position, *Upper Canada*: Departure, —.66 inch. Precipitation, ne. quadrant, no reports; se. quadrant, five stations; sw. quadrant, thirteen stations; nw. quadrant, no reports.

3 p. m. Position, *Gulf of Saint Lawrence*: Departure, —.70 inch. Precipitation, ne., se., nw. quadrants, no reports; sw. quadrant, fourteen stations. From this region the depression moved thence eastward to the Atlantic.

The following notes from observers will serve to indicate the severity of this storm:

Marquette, Michigan: snow and sleet, accompanied by high easterly wind, prevailed throughout the 17th; maximum velocity of the wind, thirty-nine miles per hour, at 3.07 p. m.; telegraph and telephone poles and wires were blown down in several places, and travel was greatly impeded by snow. The breakwater harbor light was broken from its fastenings and carried into the lake by the waves, which were unusually high. The schooner "Florida"

arrived while the gale was at its height, and in a heavy snow-storm, she was laden with coal and was driven on the beach, becoming a total wreck. At 10.55 a. m. of the 18th the wind again began to blow hard; maximum velocity, twenty-eight miles per hour from the northwest, at noon. The steam-barges "Robert Wallace" and "David Wallace" were driven ashore about four miles from Marquette and suffered serious damage; the cargo, 105,000 bushels of wheat, was lost. The steam-barge "Manistee," towing the barges "Marinette" and "Menominee," laden with lumber, was struck by the gale with great force on the night of the 18-19th, when twenty miles off Manitou Island. The tow-line broke and the vessels drifted apart and became water-logged, most of their rigging was carried away, and the "Manistee" and "Marinette" were driven ashore near Burnham and became total wrecks. The crews of both vessels, fourteen persons, were lost.

Grand Haven, Michigan: light snow began falling at 12.05 a. m. of the 18th and continued throughout the day. High southwesterly winds prevailed until the afternoon of the 19th, reaching at 3.05 p. m. of the 18th a maximum velocity of sixty miles per hour. The waves of the lake were very high, rising above the fog-horn on the outer pier, and flowing over a trestle work thirty feet in height. The boat house of the Life Saving Service was washed into the lake and considerable damage was done to other property along the lake shore. During the storm the schooner "Helen" was lost with all on board; the schooner "South Haven" was blown on the beach north of Muskegon and broke up rapidly.

Escanaba, Michigan: during the 17th heavy snow fell nearly all day; at 5 a. m. a northeasterly gale set in and continued until after midnight. The barometer fell rapidly during the 17th and 18th, and at 7 a. m. of the 18th reached the unusually low point of 29.05 inches. At 1 a. m. the wind veered to the southwest and during the afternoon to the northwest. This storm was one of the severest and most destructive that has occurred here for several years; reports have been received from many points along the lakes of vessels wrecked and lives lost. No disasters occurred in the immediate vicinity of Escanaba as the cautionary signal was displayed in time to give ample warning to ship captains.

Alpena, Michigan: rain fell during the early morning of the 17th, turning to snow at 6 a. m., and again into rain at 7.30 a. m. A wind storm set in at 7.18 a. m., accompanied by heavy rain, which continued nearly all day; maximum velocity, thirty-three miles per hour from the east, at 7.58 p. m. During the 18th light snow fell and the wind blew a gale from the southwest. This storm was unusually severe and destructive on the lakes, and many vessels were lost; the schooner "Itasca," from Buffalo to Milwaukee, laden with coal, encountered, when about twenty-five miles north of Alpena, a heavy gale blowing from the south and southwest, which carried away her sails and otherwise damaged her; she was brought into this port for repairs. The observer at this station states that this storm was more disastrous to shipping than any that has visited the lakes for a number of years, and that the timely warning given of the approach of the storm was undoubtedly the means of preventing many losses to shipping that otherwise would have occurred.

Mackinaw City, Michigan: an easterly gale, with light rain and snow at intervals, prevailed during the 17th. The total movement of the wind for the twenty-four hours ending 11 p. m. was 951 miles; maximum velocity, fifty-three miles per hour from the east, at 10.30 p. m. At 7 a. m. the barometer stood at 29.95; at 11 p. m. it had fallen to 29.19, a fall of .76 inch in sixteen hours. At 1.45 a. m. of the 18th the wind shifted to south and the gale subsided until 8 a. m., when the wind again increased in force shifting to the west at 4.30 p. m. and attaining a velocity of thirty-nine miles per hour at 10.50 p. m. The water of the lake was very high on the 18th, overflowing the wharves and carrying away two piers and injuring others. The schooner "C. B. Jones," from Buffalo to Chicago, dragged her anchor and struck the beach, breaking her shoe and rudder; she floated off when the wind shifted. During the gale and snow storm of the night of the 18-19th the schooner "Marsh" ran ashore on Graham's shoals; the schooner "Harvey Bissell" went ashore at Green Island, but was gotten off with slight damage.

Sandusky, Ohio: light snow began falling at 7.20 a. m. of the 18th and continued at short intervals throughout the day. The wind blew hard from the southwest during the morning and veered to the west during the night. Owing to high west and northwesterly winds the water in the harbor was lower than it has been for several years. Maximum velocity of wind forty-six miles per hour from the southwest.

Rochester, New York: high westerly winds, with heavy rain, prevailed during the morning and afternoon of the 18th, with light snow at night; the maximum velocity of the wind, thirty-eight miles per hour, was recorded at 7.10 a. m. The gale continued until 9.45 p. m. of the 19th, and at 12.10 p. m. a velocity of forty-eight miles per hour from the west was recorded. The storm did considerable damage on the lake; several schooners and barges were driven ashore at Charlotte.

Buffalo, New York: rain began falling at 1.30 a. m. of the 17th and continued until 9.05 a. m. of the 18th; snow began falling at 6.05 p. m. and continued until after midnight, temperature falling rapidly. A severe gale set in from the southwest at 1.20 a. m. of the 18th, and continued throughout the entire day, reaching a maximum velocity of fifty-eight miles per hour at 9.55 a. m. The gale continued throughout the 19th the wind being from the west all day, reaching a velocity of fifty-two miles per hour several times during the 19th. Considerable damage was done to property in this city and over the surrounding country by high wind and the heavy waves from the lake. No severe casualties occurred to shipping during this storm, which is due to the timely warning given.

Erie, Pennsylvania: during the 18th heavy rain fell and the wind blew hard

from the west, maximum velocity forty-three miles per hour; heavy snow fell from 6.45 to 9.00 a. m., and from 11.25 a. m. to 4.40 p. m. of the 19th. The wind storm continued until 3 p. m. of the 19th, prevailing direction, west. Considerable damage was done to vessels and other property along the wharf by the high waves of the lake; numerous vessels were broken from the wharves, and many houses damaged by water.

Below is an estimate, from the "Evening Wisconsin," of Milwaukee, of the value of the vessels driven ashore or wrecked on the lakes by this storm, together with the number of lives lost. Many of the vessels were rescued, but the wrecking expense at this season of the year was necessarily large:

Vessels.	Pecuniary loss.	Lives lost.	Vessels.	Pecuniary loss.	Lives lost.
Dickinson	\$5,000	3	Buckhout	\$2,500	.....
Emerald	5,000	5	McDougal	2,500	.....
Marquette	15,000	7	Lyman Casey	2,500	.....
Menasha	15,000	7	B. M. Baker	2,500	.....
Lacrosse	25,000	9	Star of the North	2,500	.....
Helen	2,500	6	Golden Harvest	2,500	.....
Florida	8,000	1	J. G. Koffage	3,500	.....
Pathfinder	30,000	.....	Mary	5,500	.....
William Jones	2,000	.....	Thomas P. Sheldon	16,000	.....
South Haven	3,000	.....	Queen of the Lakes	5,000	.....
Wallace and consort ..	300,000	.....	Danville	3,500	.....
F. S. Marsh	16,000	.....	Unadilla	18,000	.....
Harvey Bissell	15,000	.....	Ida Walker	8,000	.....
City of New York	25,000	.....	Wm. Jones	4,000	.....
Libbie Nau	4,000	.....	Evening Star	4,500	.....
Cuyahoga	2,500	.....	Chris Grover	4,500	.....
Tallahassee	1,500	.....		
Kellie Church	1,500	.....		
			Total	\$31,100	38

* Including grain cargoes.

Philadelphia, Pennsylvania: on the 18th light rain fell from 2 a. m. until 9.50 a. m., when unusually heavy rain began falling and continued about twenty minutes; during this time the wind blew a gale of forty miles per hour.

Atlantic City, New Jersey: a southerly gale set in at 12.30 a. m. of the 18th and continued until noon, attaining a maximum velocity of forty-two miles per hour at 11.30 a. m.

Albany, New York: a severe wind storm occurred on the afternoon of the 18th; a brick house in course of construction was blown down, crushing a smaller house as it fell.

Lynchburg, Virginia: during the early morning of the 18th the wind blew hard from the southwest, doing considerable damage in and about the city; numerous windows were broken and trees and roofs blown down. At Dearington, a small place on the outskirts of the city, two frame houses were blown down. The storm was especially severe in the vicinity of the agricultural fair grounds.

Notes in reference to other meteorological phenomena, occurring during the prevalence of this area of low pressure, will be found in this REVIEW under "Local storms and tornadoes" and "Snow."

VIII.—18th, 7 a. m. Position, *central Pennsylvania*: Departure, —.68 inch.

This low-pressure area having formed as a secondary depression to number vii it was found necessary to consider the distribution of precipitation in the description of the latter.

3 p. m. Position, *eastern Maine*: Departure, —.64 inch.

10 p. m. Position, *New Brunswick*: Departure, —.71 inch.

19th, 7 a. m. The depression united in the Gulf of Saint Lawrence with area number vii and thence moved eastward to the Atlantic.

IX.—20th, 7 a. m. Position, *Washington Territory*: Departure, —.60 inch. Precipitation, ne. quadrant, three stations; se. quadrant, three stations; sw. quadrant, no reports; nw. quadrant, one station.

3 p. m. Position, *northeast Oregon*: Departure, —.68 inch. Precipitation, ne. quadrant, two stations; se. quadrant, one station; sw. quadrant, five stations; nw. quadrant, three stations.

10 p. m. Position, *southern Idaho*: Departure, —.78 inch. Precipitation, ne. quadrant, one station; se. quadrant two stations; sw. quadrant, five stations; nw. quadrant, two stations.

21st, 7 a. m. Position, *northern Utah*: Departure, —.85 inch. Precipitation, ne. quadrant, three stations; se. quadrant, fifteen stations; sw. quadrant, four stations; nw. quadrant, four stations.

3 p. m. Position, *central Utah*: Departure, —.99 inch. Pre-

cipitation, ne. quadrant, six stations; se. quadrant, fifteen stations; sw. quadrant, one station; nw. quadrant, three stations.

10 p. m. Position, *central Colorado*: Departure, —.74 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, fifteen stations; sw. quadrant, one station; nw. quadrant, nine stations.

22d, 7 a. m. Position, *central Nebraska*: Departure, —.78 inch. Precipitation, ne. quadrant, thirteen stations; se. quadrant, twenty-two stations; sw. quadrant, six stations; nw. quadrant, six stations.

3 p. m. Position, *southern Dakota*: Departure, —1.02 inches. Precipitation, ne. quadrant, seven stations; se. quadrant, twenty-eight stations; sw. quadrant, three stations; nw. quadrant, eight stations.

10 p. m. Position, *northern Minnesota*: Departure, —1.04 inches. Precipitation, ne. quadrant, no reports; se. quadrant, thirty-nine stations; sw. quadrant, twelve stations; nw. quadrant, three stations.

23d, 7 a. m. Position, *Lake Superior*: Departure, —.87 inch. Precipitation, ne. quadrant, no reports; se. quadrant, forty-four stations; sw. quadrant, five stations; nw. quadrant, eight stations.

3 p. m. Position, *north of Lake Superior*: Departure, —.95 inch. Precipitation, ne. quadrant, four stations; se. quadrant, twenty-eight stations; sw. quadrant, nine stations; nw. quadrant, nine stations.

10 p. m. Position, *northern Canada*: Departure, —1.02 inches. Precipitation, ne. quadrant, four stations; se. quadrant, fourteen stations; sw. quadrant, twenty-six stations; nw. quadrant, no reports.

24th, 7 a. m. Position, *Upper Canada*: Departure, —.76 inch. Precipitation, ne. quadrant, three stations; se. quadrant, seven stations; sw. quadrant, seventeen stations; nw. quadrant, no reports.

3 p. m. Position, *Gulf of Saint Lawrence*: Departure, —.68 inch. Precipitation, ne. quadrant, no reports; se. quadrant, two stations; sw. quadrant, ten stations; nw. quadrant, no reports. From this region the depression moved thence eastward to the Atlantic.

The following notes from Signal Service observers are of interest:

Mackinaw City, Michigan: brisk southeasterly winds, average velocity twenty miles per hour, began at 6 a. m. of the 22d, and gradually increased in force until 3 p. m., when a gale, with snow, set in and continued throughout the day; maximum velocity, fifty-three miles per hour from the east, at 8.15 p. m. The gale ended at 7.30 a. m. of the 23d; at 2.45 p. m. the wind shifted to the southwest and suddenly increased to the force of a gale; maximum velocity thirty-eight miles per hour; at 8.15 it changed to west and blew at the rate of thirty-two miles per hour. The docks were badly damaged by the high waves caused by this storm.

Port Huron, Michigan: on the 22d a heavy wind storm set in from the south-east at 12.55 p. m., and at 10.35 p. m. was blowing at the rate of thirty miles per hour; the wind continued high until 12.15 a. m. of the 23d. A gale from the southwest began at 1 p. m. and reached a height of forty-four miles per hour at 7 p. m.

Rochester, New York: on the morning of the 23d the wind blew hard from the south, attaining the force of a gale at 4.15 a. m.; maximum velocity, forty-four miles per hour, at 5.45 a. m.; the gale ended at 5.40 a. m. At 7.30 p. m. the wind again increased in force, blowing from the southwest, and soon attained the velocity of a gale, forty miles per hour being recorded at 8.15 p. m. During the storm several chimneys and roofs were blown off in this city, and in the surrounding country numerous barns were damaged and fences blown down.

X.—22d, 10 p. m. Position, *southern Texas*: Departure, —.44 inch. Precipitation, ne. quadrant, four stations; se. quadrant, two stations; sw. quadrant, none; nw. quadrant, three stations.

23d, 7 a. m. Position, *Texas coast*: Departure, —.36 inch. Precipitation, ne. quadrant, five stations; se. quadrant, no reports; sw. quadrant, none; nw. quadrant, none.

3 p. m. Position, *Texas coast*: Departure, —.25 inch. Precipitation, ne. quadrant, eight stations; se. quadrant, no reports; sw. quadrant, one station; nw. quadrant, no reports.

10 p. m. Position, *coast of Louisiana*: Departure, —.32

inch. Precipitation, ne. quadrant, five stations; se. quadrant, no reports; sw. quadrant, none; nw. quadrant, none.

24th, 7 a. m. Position, *east of New Orleans*: Departure, —.31 inch. Precipitation, ne. quadrant, six stations; se. quadrant, one station; sw. quadrant, none; nw. quadrant, one station.

3 p. m. Position, *west Florida*: Departure, —.26 inch. Precipitation, ne. quadrant, four stations; se. quadrant, none; sw. quadrant, three stations; nw. quadrant, none.

10 p. m. Position, *southern Georgia*: Departure, —.30 inch. Precipitation, ne. quadrant, four stations; se. quadrant, none; sw. quadrant, three stations; nw. quadrant, one station.

25th, 7 a. m. Position, *central North Carolina*: Departure, —.50 inch. Precipitation, ne. quadrant, nine stations; se. quadrant, one station; sw. quadrant, seven stations; nw. quadrant, nine stations.

3 p. m. Position, *off Delaware coast*: Departure, —.64 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, no reports; sw. quadrant, eleven stations; nw. quadrant, twenty-seven stations.

10 p. m. Position, *off Massachusetts coast*: Departure, —.64 inch. Precipitation, ne. quadrant, five stations; se. quadrant, no reports; sw. quadrant, twenty-four stations; nw. quadrant, sixteen stations.

26th, 7 a. m. Position, *Gulf of Saint Lawrence*: Departure, —.94 inch. Precipitation, ne. quadrant, no reports; se. quadrant, three stations; sw. quadrant, nineteen stations; nw. quadrant, no reports. From this region the depression moved thence eastward to the Atlantic.

XI.—24th, 3 p. m. Position, *British Columbia*: Departure, —.09 inches. Precipitation, ne., se., and nw. quadrants, none; sw. quadrant, four stations.

10 p. m. Position, *Province of Assiniboia, British America*: Departure, —.30 inch. Precipitation, ne. quadrant, two stations; se. quadrant, none; sw. quadrant, two stations; nw. quadrant, none.

25th, 7 a. m. Position, *northwest Dakota*: Departure, —.52 inch. Precipitation, ne. quadrant, none; se. quadrant, three stations; sw. quadrant, none; nw. quadrant, one station.

3 p. m. Position, *central Nebraska*: Departure, —.12 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, none; sw. quadrant, none; nw. quadrant, two stations. During the day the depression filled up and disappeared in the lower Missouri valley.

XII.—27th, 3 p. m. Position, *Province of Assiniboia, British America*: Departure, —.04 inch. Precipitation, in all quadrants, no reports.

10 p. m. Position, *northwest Dakota*: Departure, —.28 inch. Precipitation, ne. quadrant, three stations; se. quadrant, one station; sw. quadrant, none; nw. quadrant, none.

28th, 7 a. m. Position, *southeast Dakota*: Departure, —.35 inch. Precipitation, ne. quadrant, five stations; se. quadrant, four stations; sw. quadrant, none; nw. quadrant, five stations.

3 p. m. Position, *east Iowa*: Departure, —.51 inch. Precipitation, ne. quadrant, nineteen stations; se. quadrant, three stations; sw. quadrant, one station; nw. quadrant, four stations.

10 p. m. Position, *Lake Michigan*: Departure, —.49 inch. Precipitation, ne. quadrant, ten stations; se. quadrant, four stations; sw. quadrant, five stations; nw. quadrant, nine stations.

29th, 7 a. m. Position, *north of Lake Ontario*: Departure, —.57 inch. Precipitation, ne. quadrant, three stations; se. quadrant, four stations; sw. quadrant, ten stations; nw. quadrant, three stations.

3 p. m. Position, *Upper Canada*: Departure, —.41 inch. Precipitation, ne. quadrant, one station; se. quadrant, one station; sw. quadrant, sixteen stations; nw. quadrant, no reports.

10 p. m. Position, *mouth of Saint Lawrence River*: Departure, —.29 inch. Precipitation, ne. quadrant, no reports; se. quadrant, five stations; sw. quadrant, seven stations; nw.

quadrant, no reports. From this region the depression moved thence eastward to the Atlantic.

XIII.—28th, 3 p. m. Position, *Province of Alberta, British America*: Departure, —.09 inch. Precipitation, ne. quadrant, no reports; se. quadrant, two stations; sw. quadrant, none; nw. quadrant, one station.

10 p. m. Position, *eastern Montana*: Departure, —.28 inch. Precipitation, ne. quadrant, two stations; se. quadrant, three stations; sw. quadrant, one station; nw. quadrant, no reports.

29th, 7 a. m. Position, *southern Dakota*: Departure, —.30 inch. Precipitation, ne. quadrant, five stations; se. quadrant, three stations; sw. quadrant, none; nw. quadrant, three stations.

3 p. m. Position, *southern Iowa*: Departure, —.35 inch. Precipitation, ne. quadrant, four stations; se. quadrant, three stations; sw. quadrant, one station; nw. quadrant, three stations.

10 p. m. Position, *southeast Missouri*: Departure, —.38 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, one station; sw. quadrant, none; nw. quadrant, one station.

30th, 7 a. m. Position, *eastern Kentucky*: Departure —.44 inch. Precipitation, ne. quadrant, seven stations; se. quadrant, three stations; sw. quadrant, two stations; nw. quadrant, ten stations.

3 p. m. Position, *off Virginia coast*: Departure, —.53 inch. Precipitation, ne. quadrant, four stations; se. quadrant, no reports; sw. quadrant, two stations; nw. quadrant, thirteen stations.

10 p. m. Position, *off Long Island*: Departure, —.56 inch. Precipitation, ne. quadrant, five stations; se. quadrant, no reports; sw. quadrant, nine stations; nw. quadrant, five stations.

A description of this depression throughout the remainder of its course will appear in the REVIEW for December.

XIV.—29th, 3 p. m. Position, *Province of Saskatchewan, British America*: Departure, —.35 inch. Precipitation, ne. quadrant, two stations; se. quadrant, four stations; sw. quadrant, three stations; nw. quadrant, no reports.

10 p. m. Position, *Province of Assiniboia, British America*: Departure, —.41 inch. Precipitation, ne. quadrant, four stations; se. quadrant, two stations; sw. quadrant, none; nw. quadrant, four stations.

30th, 7 a. m. Position, *southern Dakota*: Departure, —.42 inch. Precipitation, ne. quadrant, eight stations; se. quadrant, two stations; sw. quadrant, none; nw. quadrant, four stations.

3 p. m. Position, *east Minnesota*: Departure, —.29 inch. Precipitation, ne. quadrant, five stations; se. quadrant, nine stations; sw. quadrant, five stations; nw. quadrant, six stations.

10 p. m. Position, *Lake Superior*: Departure, —.32 inch. Precipitation, ne. quadrant, no reports; se. quadrant, two stations; sw. quadrant, twelve stations; nw. quadrant, three stations.

A description of this depression throughout the remainder of its course will appear in the REVIEW for December.

NORTH ATLANTIC STORMS DURING NOVEMBER, 1886.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to December 21, 1886.

Twelve depressions are traced, of which three, numbers 7, 9, and 12, passed eastward over Newfoundland; number 1 first appeared south of Nova Scotia, in about N. 37°, and

passed eastward, disappearing after the 2d; number 2 is first charted southwest of Iceland under date of the 1st, from which position it moved slowly southeastward until the 3d, after which date it circled northeast and passed beyond the region of observation by the 5th; number 3 apparently developed over the Bay of Biscay on the 6th and passed eastward; number 4 moved southeastward over the British Isles during the 8th and 9th, and was central over the Bay of Biscay on the 10th and 11th, after which it apparently circled northward and passed over England in a northeasterly direction during the 12th; number 5 is traced from the south of Newfoundland on the 8th to the northward of the British Isles by the evening of the 12th; number 6 originated southeast of Newfoundland on the 12th, and, following a generally northeast course, disappeared to the northward of the British Isles during the 15th; number 7 passed over the northern portion of Newfoundland during the early morning of the 6th, and, circling eastward, disappeared in the direction of the British Isles on the 19th; number 8 is traced from the coast of the United States, in the vicinity of Cape Cod, northeastward over Newfoundland, where it united with number 9 on the 20th; number 9 passed eastward over the northern portion of Newfoundland during the early morning of the 20th, and apparently dissipated over mid-ocean after the 21st; number 10 appeared over mid-ocean, in N. 45°, on the 23d, subsequent to which date it filled up; number 11 was central over mid-ocean, in N. 49°, on the 26th, after which it dissipated to the eastward; number 12 passed eastward over Newfoundland during the night of the 26th and disappeared in the direction of Scotland on the 28th.

The general character of the weather over the north Atlantic Ocean during the month was exceedingly severe, and terrific westerly gales, with tremendous seas, were reported by many trans-Atlantic vessels during the first half of the month. A large number of vessels arrived at American ports badly damaged by storms, and great quantities of wreckage were passed close to the coast, showing that a number of vessels must have foundered. A large portion of the debris passed consisted of petroleum barrels. Violent storms, occasioned by barometric depressions which passed over the eastern portion of the United States without advancing beyond the coast line, were experienced in the Maritime Provinces and over the ocean west of the sixtieth meridian. The first, and a portion of the second, decades of the month were marked by storms of great violence over the British Isles and adjacent waters. For the first decade five depressions are traced; for the second, three, and for the third, four; the tracks predominating east of the forty-fifth meridian. The general course of direction of the storm-tracks was north of east, the exception being number 4, which pursued an abnormal southerly course, afterwards circling northward.

In November, 1885, the paths of nine areas of low pressure were shown, three of which passed into the Atlantic from the American continent; two appeared on the Banks of Newfoundland, and one over the Gulf of Saint Lawrence; one occupied the ocean to the northwest of the British Isles during the 2d and 3d, and of the remaining depressions one apparently developed over the ocean between the coast of the United States and Bermuda, while one appeared in the vicinity of the Azores during the second decade of the month. The general direction of movement of the storm-centres was northeasterly or east-northeasterly, inclining to the southward after the storm-centres had passed to the eastward of the thirtieth meridian.

In November, 1886, the month opened with a depression central to the northwest of the British Isles and one to the southward of Nova Scotia; in the vicinity of the Azores the pressure ranged to about 30.34 (770.6). During the first six days of the month the barometer rose steadily over the western half of the ocean, but continued relatively low over the eastern half. On the 7th there was an appreciable decrease in pressure off the coast of the United States and the development or passage of a storm-area to the southward of Iceland was indicated.

From the 7th to the 10th, inclusive, severe storms were experienced over the ocean south of Nova Scotia and Newfoundland and over the British Isles and the Bay of Biscay and along the French coast, the pressure continuing high over mid-ocean. During the 11th, 12th, and 13th the area of high pressure moved slowly southeast in the direction of the Azores, making way for depressions which occupied the ocean to the northward until the 15th. From the 16th to the 20th the pressure was generally low over the entire ocean, with unsettled weather from coast to coast. From the 20th to the 27th the pressure was high over the British Isles and the ocean east of the twentieth meridian, while over the middle and western portions of the ocean the barometric fluctuations were frequent and marked. During the last three days of the month the barometric pressure increased over mid-ocean, which condition extended to the European coast by the 30th.

The following are brief descriptions of the depressions traced:

1.—This storm was central on the morning of the 1st in about N. 37°, W. 66°, with central pressure about 29.60 (751.8), whence it passed slightly north of east to N. 38°, W. 59° by the 2d, after which it apparently dissipated to the eastward.

The following special reports have been rendered relative to this storm:

Capt. W. A. Freethy, of the s. s. "Jeanie," reports a whole gale on the 1st from wnw., veering to n.; lowest barometer, 29.60 (751.8), at 11 p. m., in N. 35° 50', W. 70° 40'. Mate G. Cushing, of the bark "Neptune," Captain Beal, commanding, reports a strong nw. gale, commencing at 4 a. m. of the 1st, which continued until midnight; position at noon, N. 38° 22', W. 71° 10'. Mate Oliver Anderson, of the bark "Lilian B. Jones," Capt. E. F. Petrie, commanding, reports a strong gale from the w., beginning at 1 p. m. of the 1st, in N. 35° 12', W. 70° 42' (at noon); wind veered to nw. at noon of the 2d, in N. 36° 14', W. 70° 47', blowing strong gale, which increased to heavy gale during the p. m. and moderated at midnight; lowest barometer 29.53 (750.0). Capt. J. Beers, of the s. s. "Alliance," reports a whole westerly gale from the 1st to the 3d; position at noon of the 2d, N. 39° 32', W. 73° 45'.

2.—This depression was central on the 1st in about N. 59°, W. 27°, with pressure ranging below 29.00 (736.6), whence it moved slowly southeast to N. 55°, W. 21° by the 3d, accompanied by severe gales and an appreciable rise in barometric pressure. By the 4th the storm-centre had circled slightly north of east to N. 56°, W. 13°, thence passing northeast beyond the region of observation by the 5th.

The following reports exhibit the general character of this storm:

Chief Officer Miller, of the s. s. "Scandinavian," Capt. John Park, commanding, reports a strong gale from sw., veering to nw., from the 1st to the 3d; lowest barometer, 29.30 (744.2), at 8 a. m. of the 1st, in N. 53° 38', W. 23° 15'. The gale was accompanied by high seas throughout, and hard squalls and showers of rain at times. Capt. F. Bouchette, of the s. s. "Montreal," reports a heavy gale from s. to w. on the 1st; gale commenced at 9 a. m. and backed and veered in squalls, with heavy rain and high, confused sea, and veered to westward at 1 p. m.; position at noon, N. 55° 0', W. 16° 24', when barometer read 29.11 (739.4). Capt. S. Laub, of the s. s. "Thingvalla," reports a storm, attaining force 12, on the 2d; wind commenced from sw. and backed to sse., then veered to nw.; lowest barometer, 28.95 (735.3), at 5.30 p. m.; position at noon, N. 57° 37', W. 19° 17'. From 4 to 6 p. m. the ship's head was kept se., with stopped engines.

Capt. A. G. Braes, of the s. s. "State of Nebraska," reports a whole gale, which attained greatest force on the 2d at 2 p. m., in N. 54° 53', W. 21° 20', when barometer read 29.15 (740.4). Gale veered from s. to nw., and was accompanied by hard hail squalls in the afternoon of the 1st. Capt. Francis Bouchette, of the s. s. "Montreal," reports a hard gale during the 2d and 3d; at 6.30 a. m. the wind backed to s., blowing very hard, with high, confused sea running (position at noon, N. 54° 50',

W. $19^{\circ} 16'$; 1 p. m., furious squalls blowing with hurricane force; 4 p. m., wind commenced to veer to sw.; barometer 29.11 (739.4); 8 p. m., wind veered in a squall to w. by s.; barometer steady at 29.09 (738.9). On the 3d the wind veered to w. by n., with furious squalls, accompanied by hail and a high, confused sea; barometer rising; position at noon, N. $54^{\circ} 31'$, W. $21^{\circ} 43'$; at 1 p. m. a dangerous whirlwind passed to the north of the ship, churning up the water to a great height.

3.—The development of this storm to the southward of the British Isles was shown by vessel reports of the 5th, which indicated a depression subsidiary to number 2. By the 6th the area of low pressure was well defined over the Bay of Biscay, with strong gales to the northward and westward. By the 7th the depression had apparently passed eastward beyond the limit of reports.

The following reports refer to this storm, the one received from the s. s. "Lepanto" indicating that this vessel experienced gales in the southwest quadrant of number 2 and in the northwest quadrant of number 3.

Chief Officer Wise, of the s. s. "Lepanto," Capt. T. Irvin, commanding, reports a fresh wnw. gale during the 5th while in the English Channel, which continued until 4 a. m. of the 6th, in N. $49^{\circ} 55'$, W. $10^{\circ} 55'$ (at noon); lowest barometer, 29.42 (747.3), at 4 a. m. of the 6th. Mate F. Vogt, of the ship "Otto," Capt. W. Langen, commanding, reports a whole gale, with heavy nnw. squalls, hail, and rain, on the 6th, in N. $48^{\circ} 15'$, W. $19^{\circ} 0'$; barometer 29.77 (756.1) at noon. The s. s. "Sahara," on the 6th, in N. $51^{\circ} 10'$, W. $11^{\circ} 0'$, had a fresh gale from the northward, with high, confused sea; the ship labored and strained heavily, and the decks flooded fore and aft.

4.—This depression is first charted on the 7th in N. 59° , W. 15° , whence it moved southeast to N. 56° , W. 9° by the 8th. On the 9th it had passed southeastward over Ireland, and was central at noon (Greenwich mean time) in N. 51° , W. 6° , with heavy gales westward to the thirtieth meridian. By the 10th the storm-centre had moved into the Bay of Biscay, where it remained nearly stationary until the 11th, an increase in pressure being noticeable on the latter date. By the 12th the storm had apparently passed northward to about N. 50° , W. 5° , with central pressure about 29.50 (749.3), after which it disappeared beyond the region of marine reports.

The following special reports have been received from vessels which encountered disturbances within the area of this depression:

Chief Officer Wise, of the s. s. "Lepanto," Capt. T. Irvin, commanding, reports having experienced a strong to whole nw. gale, with mountainous seas and hurricane squalls, on the 8th, which continued throughout the 9th and 10th; ship's position at noon of the 8th, N. $49^{\circ} 30'$, W. $19^{\circ} 3'$; at noon of the 10th, N. $49^{\circ} 26'$, W. $22^{\circ} 22'$. Capt. T. Roberts, of the s. s. "Elstow," experienced a very heavy gale on the 8th, commencing at 4 a. m. and freshening gradually until midnight, when it was at its height; the wind being about nw. and backing to nnw. in squalls; position at noon, N. $50^{\circ} 57'$, W. $20^{\circ} 7'$.

Chief Officer Thorburn, of the s. s. "Bavarian," Capt. R. Leask, commanding, reports: "8th, in N. $51^{\circ} 12'$, W. $12^{\circ} 52'$ (at noon), a moderate gale began from the nw., with heavy squalls and high seas, increasing during p. m. to strong gale, nw., with violent squalls and high seas; continued through the 9th, in N. $50^{\circ} 38'$, W. $17^{\circ} 52'$ (at noon), veering to n., with violent squalls, rain, hail, and terrific seas flooding decks fore and aft; increased to heavy gale, n., in p. m.; lowest barometer, 29.48 (748.8), at noon; gale continued on 10th, in N. $49^{\circ} 48'$, W. $23^{\circ} 9'$ (at noon), veering to nne. at 9 a. m. and moderating after 4 p. m." Capt. W. Rea, of the s. s. "Bassano," reports a strong gale on the 9th and 10th from nw., backing to s., se., and ne.; lowest barometer, 29.17 (740.9), at noon of the 9th, in N. $49^{\circ} 39'$, W. $11^{\circ} 0'$. Capt. W. A. Beynon, of the s. s. "Belgenland," reports a strong gale from nw., veering to ene., during the 8th and 9th; lowest barometer, 29.24 (742.7), at 6 a. m. of the 9th, in N. $50^{\circ} 24'$, W. $14^{\circ} 47'$.

5.—This storm apparently developed off the coast of the

United States during the 7th, but was not sufficiently well defined to admit of accurately locating its centre until the 8th, when it was central in N. 43° , W. 55° , with pressure about 29.60 (751.8). From this position the depression moved slowly northeast until the 10th, after which its rate of progression was more rapid, and the storm-centre passed to the northward of the British Isles after the 12th.

The following reports indicate the general character of the depression, which showed a marked loss of energy after passing to the eastward of Newfoundland.

Capt. T. Roberts, of the s. s. "Samaria," reports a strong gale from se. veering to w. on the 7th; lowest barometer, 29.52 (749.8), at 8 a. m., in N. $42^{\circ} 30'$, W. $69^{\circ} 36'$. The gale was accompanied by high seas, fierce squalls, heavy rain, and much vivid lightning. Third Officer Prager, of the s. s. "Ems," Capt. T. Yüngst, commanding, reports a whole gale, with thunder and lightning, on the 7th; wind veered from sse. to nw., with snow squalls; lowest barometer, 29.59 (751.5), at 3.30 p. m., in N. $42^{\circ} 7'$, W. $63^{\circ} 36'$. Chief Officer Potts, of the s. s. "Palestine," Capt. W. Whiteway, commanding, reports: "7th, in N. $42^{\circ} 51'$, W. $65^{\circ} 46'$ (at noon); fresh to strong breezes from se., veering to s.; wind veered from s. to wsw. in p. m., and increased to strong gale at 3 p. m. (barometer 29.52 (749.8) at noon), with heavy rain and high seas, then veered to w., and continued strong to moderate gale until 6 a. m. of the 8th, in N. $42^{\circ} 26'$, W. $69^{\circ} 46'$ (at noon), then moderated, with clearing weather."

Capt. A. G. Braes, of the s. s. "State of Nebraska," reports a whole gale from sse., veering to w., during the 7th and 8th; lowest barometer, 29.82 (757.4), at 8.30 a. m. of the 8th, in N. $44^{\circ} 38'$, W. $54^{\circ} 55'$. The gale was accompanied by heavy rain and hail. Chief Officer Miller, of the s. s. "Scandinavian," Capt. John Park, commanding, reports a fresh gale from se., veering to nw., on the 7th and 8th; lowest barometer, 29.65 (753.1), at 6 a. m. of the 8th, in N. $43^{\circ} 22'$, W. $52^{\circ} 23'$. The gale was accompanied by very high cross seas, and veered from se. to nw. at 6 a. m. of the 8th, with heavy rain.

6.—This depression apparently developed southeast of Newfoundland, and was central on the 12th in N. 46° , W. 45° , with pressure about 29.70 (754.4), whence it passed northeast to N. 53° , W. 39° by the 13th, with an appreciable decrease in pressure; by the 14th the storm-centre had moved north of east to N. 55° , W. 25° , where pressure about 29.00 (736.6) was shown; continuing a north of east course the storm was central on the 15th in N. 57° , W. 12° , with evidence of great energy, whence it passed to the northward of the British Isles.

The following special reports refer to this storm:

Chief Officer C. H. Calvert, of the s. s. "Prussian," Capt. A. McDougall, commanding, reports a heavy gale on the 14th from w. veering to n. and backing to nw.; lowest barometer, 29.37 (746.0), at 8 a. m.; position at noon, N. $53^{\circ} 11'$, W. $28^{\circ} 8'$. Third Officer J. W. Mills, of the s. s. "Aurania," Capt. W. H. P. Hains, commanding, reports a westerly gale of force 7 to 8 on the 15th; lowest barometer, 29.15 (740.4), at 4.30 a. m., when one hundred and eighty miles west of Fastnet. Capt. G. de Kersabiec, of the s. s. "Normandie," reports a westerly gale of force 10 to 11 from the 14th to the 16th; lowest barometer, 29.17 (741.0), at 8.30 a. m. of the 15th, in N. $50^{\circ} 15'$, W. $16^{\circ} 20'$. Very high seas accompanied the gale, and the ship labored heavily.

7.—This depression passed eastward over the northern extremity of Newfoundland during the early morning of the 16th, and was central at noon (Greenwich mean time) of that date in about N. 51° , W. 53° , whence it moved eastward to N. 52° , W. 38° by the 17th, with pressure about 29.20 (741.7); from this position it passed northeast to N. 56° , W. 32° by the 18th, and circled southeast to N. 51° , W. 21° by the 19th, after which it was deflected to the northeastward and disappeared in the direction of the Scottish coast.

The following reports have been rendered relative to this storm:

Capt. W. Rea, of the s. s. "Bassano," reports a strong west-

erly gale from the 15th to the 18th, during which terrific squalls, with snow, sleet, and hail, were experienced; lowest barometer, 29.64 (752.8), at 8 a. m. of the 17th, in N. 44° 51', W. 49° 30'. On the night of the 17th, from 10 to 11.30 p. m., the ship was covered with electrical lights fore and aft. Capt. H. Perry, of the s. s. "Britannic," reports a strong westerly gale on the 17th, with violent squalls of wind and hail; lowest barometer, 29.39 (746.5), at 4 p. m.; position at noon, N. 46° 43', W. 47° 31'. Capt. G. de Kersabiec, of the s. s. "Normandie," reports a westerly gale of force 10 from the 17th to the 19th; lowest barometer, 29.57 (751.0), on the 17th, in N. 47° 48', W. 42° 30'. The disturbance began in a squall of snow from the w., and was accompanied by very heavy seas. Chief Officer Kinning, of the s. s. "Roman," Capt. D. Williams, commanding, reports: "19th, in N. 49° 55', W. 35° 36' (at noon), strong gale began at 11.30 p. m. from s., with heavy gusts; wind increased to a hard gale from s. in a. m. of the 20th, in N. 48° 48', W. 40° 33' (at noon), with heavy seas; at 10 a. m. the wind veered suddenly to nw. with heavy rain, and backed to w. in p. m., blowing strong gale with heavy squalls; veered to nw. in a. m. of the 21st and moderated; lowest barometer, 29.35 (745.5), at noon of the 20th."

8.—The presence of this depression over the ocean off Long Island was shown by vessel reports of the 18th, whence it moved eastward to N. 44°, W. 59° by the 19th, with central pressure about 29.20 (741.7); from this position it circled northeast over Newfoundland and united with low area number 9 on the 20th.

The following special reports refer to this storm:

Capt. W. A. Beynon, of the s. s. "Belgenland," reports a moderate gale on the 18th, from s. veering to nw.; lowest barometer, 29.33 (745.0), at 1 p. m., in N. 40° 46', W. 72° 20'. During the gale the barometer fell .20 in one hour; the wind shifted at 1.30 p. m., in a squall, with heavy rain from sw. to w. Chief Officer W. Scott, of the s. s. "Dunholme," Captain Wilkinson, commanding, reports a strong to whole gale on the 18th, in N. 38° 0', W. 71° 0' (at noon); wind veered from s. to w. at 6.30 p. m.; lowest barometer, 29.53 (750.0), at 8 p. m.; gale continued, veering to wnw. during the 19th and 20th. Capt. E. Orcutt, of the bark "Don Justo," experienced a heavy gale from ssw. veering to wsw. on the 18th, in N. 42° 30', W. 70° 30'. The gale was accompanied in the morning by heavy rain, thunder, and lightning, and during the afternoon by snow-squalls; barometer 29.67 (753.6) at 7 a. m. The gale continued strong, wsw., through the 19th, in N. 42° 35', W. 70° 35'; barometer 29.47 (748.5) at 7 a. m., then rising.

Capt. H. Perry, of the s. s. "Britannic," reports a fresh gale on the 19th in N. 42° 57', W. 59° 1' (at noon). Gale set in from s. at 4 a. m., with heavy rain, and veered to wnw. at 8.30 a. m.; at 4 p. m. backed to w., with violent squalls of wind, hail, and sleet; lowest barometer, 29.21 (741.9), at 8 a. m.; gale continued from w. during the a. m. of the 20th, and barometer rose slowly. Chief Officer Secomba, of the s. s. "Cephalonia," Capt. H. Walker, commanding, reports a strong to whole s. to w. gale on the 19th in N. 42° 37', W. 64° 48' (at noon); wind veered to w. at 2.30 a. m.; lowest barometer, 29.55 (750.6), at 4 p. m. Capt. W. Kühlewein, of the s. s. "Gellert," reports a heavy gale, with high seas and squalls, on the 19th; barometer fell to 29.49 (749.0); position at noon, N. 41° 9', W. 66° 0'.

9.—This storm passed eastward over the northern portion of Newfoundland during the early morning of the 20th, with evidence of great energy and strong gales southward to the fortieth parallel; by the 21st it had moved rapidly eastward to N. 50°, W. 36°, where a marked loss of strength was apparent; after this date the depression apparently passed eastward and dissipated over mid-ocean.

The following special reports have been received relative to disturbances encountered during the passage of this depression:

Capt. H. C. v. d. Zee, of the s. s. "Zaandam," reports a storm on the 20th and 21st from sse., veering to w.; lowest barometer, 29.38 (746.2), at 1.20 a. m. of the 21st, in N. 49° 24',

W. 34° 25'. Capt. J. J. Bravens, of the s. s. "De Ruyter," reports: "20th, in N. 48° 49', W. 32° 56' (at noon), in the morning wind sse., blowing fresh and squally; 2.10 p. m., barometer 29.77 (756.1); 6.10 p. m., barometer 29.59 (751.6), wind a whole gale from the s., with a very high sea from wsw. and s.; brought the ship to; 10.10 p. m., barometer 29.51 (749.5), wind a whole gale from s. by w., with a very high sea; 11.10 p. m., barometer 29.42 (747.3); gale moderating from sw." Capt. G. de Kersabiec, of the s. s. "Normandie," reports a westerly gale of force 10 to 11 from the 19th to 21st; lowest barometer, 29.45 (748.0), at 9.30 a. m. of the 21st, in N. 43° 35', W. 54° 47'. The sea was monstrous from the west, washing over to the height of the bridge and funnels, and the ship labored heavily.

10.—This depression is charted for one day only, vessel reports of the 23d locating its centre on that date in about N. 45°, W. 37°; from this position it apparently passed northeast and dissipated.

The following special reports indicate its general character.

Capt. M. de Jouselin, of the s. s. "La Bretagne," reports a strong gale during the 23d and 24th; lowest barometer, 29.69 (754.0), at 11 p. m. of the 23d, in N. 49° 15', W. 33° 0'; wind veered from s. to n. Capt. R. Teed, of the bark "Kate Cann," reports a moderate to strong gale on the 23d and 24th, commencing from sw. on the 23d, in N. 39° 21', W. 36° 19'; wind backed to s., with high seas at noon, when barometer stood 29.42 (747.3) and increased to strong gale, s., in a. m. of the 24th, veering to sw. and moderating in p. m.

11.—This storm appeared over mid-ocean, in N. 49°, W. 26°, on the 26th. The depression advanced from the westward, but was not sufficiently well-defined previous to the 26th to admit of accurately locating its centre; subsequent to the date for which it is charted the storm moved east or north of east and disappeared.

The following reports have been made in connection with this storm:

Capt. Edward Bentley, of the s. s. "Wisconsin," reports a fresh westerly gale on the 25th and 26th; lowest barometer, 29.70 (754.4), at midnight of the 25th, in N. 47° 40', W. 41° 30'. Commodore W. G. Randle, commanding the s. s. "Westernland," reports a strong sw. to nw. gale from the 25th to 27th; lowest barometer, 29.62 (752.3), at 1 a. m. of the 26th, in N. 44° 42', W. 34° 30'.

12.—This depression passed north of east over Newfoundland during the 26th, and was central at 12 noon (Greenwich mean time) of the 27th in N. 52°, W. 39°, without evidence of special strength; fresh gales were, however, reported to the southward; by the 28th the storm-centre had moved northeastward to N. 56°, W. 21°, accompanied by fresh to strong gales; from this position the storm passed to the north of Scotland by the 29th.

The following special reports refer to storms encountered within the area of this depression:

Capt. H. Parsell, of the s. s. "Adriatic," reports a strong gale on the 26th, from s. veering to wnw.; lowest barometer, 29.64 (752.8), at 8 a. m., in N. 42° 13', W. 62° 0'. Capt. John Jenkins, of the s. s. "Ripon City," reports a whole gale from s. veering to wnw. on the 26th and 27th; lowest barometer, 29.30 (745.5), at 8 a. m. of the 27th, in N. 51° 0', W. 37° 0'.

On the 27th the s. s. "Westernland," in N. 48° 15', W. 42° 55' (at noon), encountered a huge sea at 2.45 p. m. The wave rose just ahead of the ship and fell on the bow like the bursting of a water-spout. Twenty-nine feet of the whaleback was crushed in, and four seamen were immediately killed; sixteen others of the crew and steerage passengers were more or less injured, and in a few hours two other deaths occurred. The ship's position at the time this wave was encountered was in the southwest quadrant of the area of low pressure, and it is probable that, owing to the relative shallowness of the depression, the wave was generated by a subsidiary whirl, and partook of the nature of a water-spout.

Capt. B. Gleadell, of the s. s. "Germanic," reports a strong

gale from the 27th to the 29th; wind veered from s. to nw.; lowest barometer, 29.99 (761.7), at 10.30 a. m. of the 28th, in N. 51° 15', W. 21° 0'. Capt. J. J. Small, of the s. s. "Bolivia," reports a whole gale from s. veering to nw., continuing from the 27th to 29th; lowest barometer, 29.43 (747.5), at 11 p. m. of the 28th, in N. 55° 20', W. 17° 02'.

OCEAN ICE.

The only iceberg reported during the month was observed on the 2d, in N. 45° 20', W. 45° 26', from the s. s. "Elstow," the berg being from fifty to sixty feet high.

In November, 1885, the only iceberg reported during the month was observed in N. 48° 00', W. 51° 10'. In November, 1884, several icebergs were seen in N. 45° 56', W. 52° 38', but none were reported in that month of the years 1882 and 1883.

FOG.

The following shows the limits of fog-areas encountered on the north Atlantic Ocean during November, 1886, as reported by shipmasters:

1st.—The s. s. "Virginian," in N. 43° 26', W. 49° 5' (at noon), encountered a dense fog at 3 a. m., which continued until 6 p. m., with fresh breeze from s. veering to nw. in p. m.

3d.—The s. s. "Ems," had a dense fog from N. 47° 3', W. 43° 16' to N. 46° 38', W. 44° 43', with easterly winds.

4th and 5th.—The s. s. "Tyrian," on the 4th, in N. 42° 10', W. 47° 7' (at noon), had a dense fog setting in at 10 a. m., which continued until 10 a. m. of the 5th, in N. 42° 5', W. 52° 28' (at noon), with variable winds.

6th and 7th.—The s. s. "Palestine," on the 6th, in N. 43° 50', W. 59° 55' (at noon), encountered a dense fog at 9 p. m., which continued until 2 a. m. of the 7th, in N. 42° 51', W. 65° 46' (at noon), with strong breezes veering from se. to s.

7th.—The s. s. "Bulgarian," in N. 48° 10', W. 42° 7' (at noon), had dense fog from 5 to 8 p. m., with moderate, variable breezes.

8th.—The s. s. "Iowa," in N. 44° 18', W. 52° 44', (at noon), entered a dense fog at 2.45 a. m., which continued until 5.45 p. m., with fresh sse. breezes. The s. s. "Bulgarian," in N. 46° 13', W. 47° 32' (at noon), had dense fog from 11 a. m. to 2 p. m., with fresh se. breezes.

15th.—The s. s. "Cephalonia," in N. 46° 47', W. 44° 16' (at noon), at 4.30 p. m. dense fog set in and cleared off at 7.30 p. m., with strong sw. breeze. The s. s. "Bavarian," in N. 43° 40', W. 50° 43' (at noon), had dense fog from 7 a. m. to 11.30 a. m., with wind sw., veering at 10 a. m. to w., in fresh gale. The s. s. "Prussian," in N. 52° 16', W. 33° 42' (at noon), had dense fog from 4 p. m. to 7 p. m., with moderate sw. winds.

From above reports it will be seen that fog was encountered in the localities given during November, 1886, with moderate winds blowing from the southern quadrants, which would seem to indicate that conditions favorable for the development of fog during this month would exist to the eastward of barometric depressions, with southerly winds and barometric pressure about, or slightly above, the normal.

WATER-SPOUTS.

The officers of the s. s. "Energia" report having observed a huge water-spout about half a mile ahead of them while a little below Wolf Trap Light, Chesapeake Bay, about 3 p. m. of the 25th. It came towards them from a northeast direction, and looked very threatening; finally it moved away to the southwest, where they saw it pass over to the land near the Wolf Trap, where it burst and the water went down in torrents.

SIGNAL SERVICE AGENCIES.

Signal Service agencies have been established in the Maritime Exchange buildings at New York City and Philadelphia, and in the Custom-House, Boston, where the necessary blanks and other information will be furnished to shipmasters.

In pursuance of the arrangements made with the Meteorological Office of London, England, there were cabled to that office from New York during November, 1886, five reports con-

cerning storms encountered by vessels in the Atlantic west of the forty-fifth meridian. Four messages were sent from Boston.

TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

The distribution of mean temperature over the United States and Canada for November, 1886, is exhibited on chart ii by the dotted isothermal lines; and in the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. On chart iv the departures from the normal temperature are illustrated by lines connecting stations of normal or equal abnormal values.

In New England, the middle Atlantic states, and North Carolina the mean temperature of the month is slightly above the normal; the departures in New England average 1°.8, and in the middle Atlantic states 1°.6; the largest departures in excess of the normal are at Boston, Massachusetts, excess 3°.2, New London, Connecticut, 3°.2, and Philadelphia, Pennsylvania, 3°.1. With the exception of the small section of country mentioned, the temperature of the air over the United States has been colder than the average November; the departures are quite large in the middle plateau, the middle slope, and in Oregon. At one station, Salt Lake City, Utah, the temperature is 7°.9 below the normal. West of the eighty-fifth meridian nine stations, only, show an increase of temperature, at six of these the increase is less than one degree; the other three are Leavenworth, Kansas, increase 3°.8, Rio Grande City, Texas, 2°.6, and Saint Louis, Missouri, 2°.5.

In the following table are given the mean temperatures for the several geographical districts, with the normals and departures, as deduced from Signal Service observations:

Average temperatures for November.

Districts.	Average for November, Signal-Service observations.		Comparison of Nov., 1886, with the average for several years.
	For several years.	For 1886.	
New England.....	40.7	42.5	+ 1.8
Middle Atlantic States.....	45.4	47.0	+ 1.6
South Atlantic States.....	55.0	54.7	- 0.3
Florida Peninsula.....	66.2	64.0	- 2.2
Eastern Gulf States.....	55.5	54.5	- 1.0
Western Gulf States.....	56.4	55.7	- 0.7
Rio Grande Valley.....	65.2	66.4	+ 1.2
Tennessee.....	48.2	47.6	- 0.6
Ohio Valley.....	43.2	41.8	- 1.4
Lower Lake region.....	38.8	37.8	- 1.0
Upper Lake region.....	34.2	33.1	- 1.1
Extreme Northwest.....	25.2	23.7	- 1.5
Upper Mississippi Valley.....	38.5	37.7	- 0.8
Missouri Valley.....	34.7	34.0	- 0.7
Northern slope.....	31.9	29.2	- 2.7
Middle slope.....	38.5	35.7	- 2.8
Southern slope.....	49.2	48.8	- 0.4
Southern plateau.....	47.4	44.4	- 3.0
Middle plateau.....	37.7	30.9	- 6.8
Northern plateau.....	37.8	32.9	- 4.9
North Pacific coast region.....	45.8	42.5	- 3.3
Middle Pacific coast region.....	53.3	52.3	- 1.0
South Pacific coast region.....	59.2	56.8	- 2.4

The following are some of the most marked departures from the normal temperature at Signal Service stations:

Above normal.		Below normal.	
Leavenworth, Kansas.....	3.8	Salt Lake City, Utah.....	7.9
Boston, Massachusetts.....	3.2	Las Animas, Colorado.....	5.9
New London, Connecticut.....	3.2	Winnemucca, Nevada.....	5.7
Philadelphia, Pennsylvania.....	3.1	Boise City, Idaho.....	5.4
Rio Grande City, Texas.....	2.6	Prescott, Arizona.....	5.4
Saint Louis, Missouri.....	2.5	Fort Maginnis, Montana.....	4.9
New York City.....	2.5	Denver, Colorado.....	4.7
Washington City.....	2.0	Pike's Peak, Colorado.....	3.9

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.		Least.	
Fort Assinaboine, Montana.....	88.0	Tatoosh Island, Washington Ter.....	21.5
Moorhead, Minnesota.....	86.1	Fort Canby, Washington Ter.....	21.7
Poplar River, Montana.....	78.1	Astoria, Oregon.....	24.0
Fort Maginnis, Montana.....	77.0	Key West, Florida.....	25.7
Saint Paul, Minnesota.....	76.9	Fysh, Washington Ter.....	26.5
Fort Totten, Dakota.....	76.0	Port Angeles, Washington Ter.....	28.5

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures for November for a series of years, the mean temperature for November, 1886, and the departures from the normal:

Station.	County.	Normal temperature for November.	Number of years.	Mean temperature for Nov., 1886.	Departure.
<i>Arkansas.</i>		0		0	0
Lead Hill.....	Boone.....	48.1	5	45.2	- 2.9
<i>California.</i>					
Sacramento.....	Sacramento.....	51.2	21	46.0	- 5.2
<i>Connecticut.</i>					
Middletown.....	Middlesex.....	39.3	28	39.9	+ 0.6
New Haven.....	New Haven.....	40.4	100	42.7	+ 2.3
Thompson.....	Windham.....	38.6	30	39.8	+ 1.2
<i>Dakota.</i>					
Webster.....	Day.....	33.1	4	33.0	- 0.1
<i>Florida.</i>					
Archer.....	Alachua.....	61.6	4	60.7	- 0.9
<i>Illinois.</i>					
Anna.....	Union.....	45.5	11	44.2	- 1.3
Mattoon.....	Coles.....	40.2	6	40.3	+ 0.1
Peoria.....	Peoria.....	39.4	30	39.6	+ 0.2
Riley.....	McHenry.....	33.3	36	31.3	- 2.0
Sandwich.....	De Kalb.....	30.0	35	34.6	+ 4.6
Ryanmore.....	De Kalb.....	35.8	6	32.1	- 3.7
<i>Indiana.</i>					
Lafayette.....	Tippecanoe.....	35.1	7	37.3	+ 2.2
Logansport.....	Cass.....	39.9	31	38.9	- 1.0
Spiceland.....	Henry.....	38.6	33	38.0	- 0.6
Vevay.....	Switzerland.....	43.7	21	42.7	- 1.0
<i>Iowa.</i>					
Cresco.....	Howard.....	28.7	10	26.8	- 1.9
Monticello.....	Jones.....	33.4	33	31.7	- 1.7
<i>Kansas.</i>					
Independence.....	Montgomery.....	43.9	15	43.9	0.0
Wellington.....	Sumner.....	41.1	8	43.2	+ 2.1
Yates Centre.....	Woodson.....	39.4	6	38.8	- 0.6
<i>Maine.</i>					
Belfast.....	Waldo.....	35.9	37	38.3	+ 2.4
Bridgton.....	Cumberland.....	34.5	12	34.6	+ 0.1
Cornish.....	York.....	33.7	29	35.3	+ 1.6
Gardner.....	Kennebec.....	35.7	50	37.7	+ 2.0
Orono.....	Penobscot.....	33.4	18	37.0	+ 3.6
<i>Maryland.</i>					
Fallston.....	Harford.....	42.3	16	43.1	+ 0.8
<i>Massachusetts.</i>					
Amherst.....	Hampshire.....	38.1	49	40.2	+ 2.1
Cambridge.....	Middlesex.....	39.1	64	41.6	+ 2.5
Fitchburg.....	Worcester.....	39.5	30	37.5	- 2.0
Rosemont.....	Bristol.....	39.5	16	43.6	+ 4.1
Springfield.....	Hampden.....	39.4	19	41.0	+ 1.6
Taunton.....	Bristol.....	41.3	16	42.0	+ 0.7
<i>Nevada.</i>					
Carson City.....	Ormsby.....	35.5	7	32.7	- 2.8
<i>New Brunswick.</i>					
Saint John.....	Saint John.....	35.4	26	38.4	+ 3.0
<i>New Hampshire.</i>					
Concord.....	Merrimack.....	37.4	19	39.2	+ 1.8
Hanover.....	Grafton.....	33.5	26	34.3	+ 0.8
<i>New York.</i>					
North Volney.....	Oswego.....	35.6	19	36.8	+ 1.2
Palermo.....	Oswego.....	34.1	33	34.8	+ 0.7
<i>Ohio.</i>					
Wauseon.....	Fulton.....	35.5	16	34.9	- 0.6
Westerville.....	Franklin.....	38.4	12	38.3	- 0.1
<i>Pennsylvania.</i>					
Dyberry.....	Wayne.....	34.6	19	36.6	+ 2.0
<i>South Carolina.</i>					
Stateburg.....	Sumter.....	53.7	6	53.7	0.0
<i>Texas.</i>					
New Ulm.....	Austin.....	59.1	15	58.7	- 0.4
<i>Vermont.</i>					
Lunenburg.....	Essex.....	31.3	38	33.6	+ 2.3
Newport.....	Orleans.....	33.3	11	33.5	+ 0.2
Strafford.....	Orange.....	33.9	12	37.9	+ 4.0
<i>Virginia.</i>					
Bird's Nest.....	Northampton.....	49.4	18	53.3	+ 3.9
Dale Enterprise.....	Rockingham.....	47.5	6	44.4	- 3.1
Variety Mills.....	Nelson.....	44.2	9	42.5	- 1.7
<i>West Virginia.</i>					
Helvetia.....	Randolph.....	40.6	10	39.5	- 1.1

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are furnished by voluntary observers:

Illinois.—Riley, McHenry county: the mean temperature of the autumn of 1886, 47° 9', is 1° 0' higher than the mean of the past twenty-five autumns; the autumns of 1862, 1865, 1867, 1870, 1877, 1878, 1879, 1881, 1882, and 1884 were warmer than that of 1886.

Indiana.—Vevay, Switzerland county: the highest temperature that has occurred in any November during the past twenty-one years was 78° 0', in 1865; the lowest, -2° 0', in 1880.

Spiceland, Henry county: the highest temperature that has occurred in any November during the past thirty-three years was 74° 0', in 1859; the lowest, -14° 0', in 1880.

Iowa.—Monticello, Jones county: during the past thirty-three years the highest November temperature, 70° 0', occurred in 1854, 1859, and 1879; the lowest, -11° 0', in 1863 and 1871.

Kansas.—Yates Centre, Woodson county: the mean temperature of the autumn of 1886, 56° 2', is 2° 1' above the mean of the past six years; the warmest autumn during that time occurred in 1884, mean temperature, 58° 9'.

Wellington, Sumner county: the highest November mean temperature during the past eight years, 45° 5', occurred in 1879; the lowest mean, 29° 0', in 1880; during that time the highest November temperature, 78° 0', occurred in 1882 and 1885; the lowest, -10° 0', in 1880.

Maryland.—Fallston, Harford county: during the past sixteen years the warmest November occurred in 1870, mean temperature, 46° 7'; the coldest occurred in 1873, mean, 37° 5'.

Maine.—Cornish, York county: during the past twenty-nine years the warmest November occurred in 1860, mean temperature, 37° 7'; the coldest in 1873, mean, 25° 7'.

Massachusetts.—Worcester, Worcester county: the mean temperature of the coldest November for nearly half a century was 30° 4', in 1873, and the warmest, 46° 9', in 1849.

New York.—Palermo, Oswego county: the mean temperature of the coldest November during the past thirty-three years was 26° 8', in 1873, and the warmest, 41° 9', in 1859. The mean temperature of the autumn of 1886, 43° 0', is 3° 6' below the autumn average of the past thirty-three years. The warmest autumn during that period occurred in 1855, mean temperature, 51° 1'; the coldest occurred in 1875, mean, 42° 9'.

North Volney, Oswego county: during the past nineteen years the warmest November occurred in 1885, mean temperature, 39° 2'; the coldest in 1873, mean, 29° 5'. The mean temperature of the autumn of 1886, 48° 2', is 0° 2' below the average of the past nineteen years. The coldest autumn in that time occurred in 1875, mean temperature, 44° 0'; the warmest occurred in 1881, mean, 52° 5'.

Ohio.—Wauseon, Fulton county: temperature comparisons of November during the past sixteen years: highest mean, 40° 3', in 1883; lowest mean, 27° 9', in 1880; maximum, 74° 6', in 1876 and 1882; minimum, -8° 5', in 1880. The mean temperature of the autumn of 1886, 50° 0', is 0° 1' above the average.

Texas.—New Ulm, Austin county: temperature comparisons for November during the past fifteen years: highest mean, 65° 6', in 1879; lowest mean, 49° 6', in 1880; maximum, 94° 0', in 1882; minimum, 16° 0', in 1872. The mean temperature of the autumn of 1886, 68° 5', is 0° 4' below the average.

Virginia.—Dale Enterprise, Rockingham county: during the past six years the warmest November occurred in 1883, mean temperature, 62° 3'; the coldest in 1880, mean, 41° 3'.

Variety Mills, Nelson county: during the past nine years the highest mean temperature for November, 47° 5', occurred in 1881; the lowest, 39° 5', in 1880. The mean temperature of the autumn of 1886, 54° 3', is 2° 0' below the average of the past nine autumns.

FROSTS.

Frost occurred in the various districts during the month, as follows:

New England.—2d, 5th to 10th, 12th, 14th to 30th.

Middle Atlantic states.—1st, 2d, 4th to 30th.

South Atlantic states.—1st, 2d, 3d, 5th to 10th, 13th, 14th, 16th to 20th, 25th to 29th.

Florida.—Archer, 1st, 2d, 8th, 9th, 14th, 19th, 20th, 26th to 29th; Manatee, 30th.

East Gulf states.—1st, 7th, 8th, 14th, 18th, 19th, 20th, 25th to 29th.

West Gulf states.—4th, 6th, 7th, 8th, 12th to 15th, 17th, 18th, 19th, 24th to 28th.

Rio Grande Valley.—Rio Grande City, Texas, 18th.

Tennessee.—1st to 9th, 12th to 20th, 23d to 29th.

Ohio Valley.—1st to 9th, 12th to 16th, 18th to 22d, 24th to 30th.

Lower lake region.—1st, 4th to 30th.

Upper lake region.—1st to 30th.

Extreme northwest.—1st to 30th.

Upper Mississippi valley.—1st, 3d to 8th, 10th to 21st, 23d to 30th.

Missouri Valley.—1st to 30th.

Northern slope.—1st to 27th, 30th.

Table of comparative maximum and minimum temperatures for November.

State or Territory.	Station.	For 1886.		Since establishment of station.			
		Max.	Min.	Max.	Year.	Min.	Year.
Alabama	Mobile	76.4	30.5	82.0	1879, 1882	37.0	'72, '77, '81
Do	Montgomery	79.0	31.3	83.0	1879, 1882	21.0	1872
Arizona	Prescott	71.0	2.0	75.0	1878, 1885	1.0	1880
Do	Fort Apache	72.0	3.6	77.0	1882	9.0	1880
Arkansas	Fort Smith	75.0	22.1	86.0	1883	1.0	1880
Do	Little Rock	72.7	25.0	83.0	1882	10.0	1880
California	San Francisco	75.0	45.0	78.0	1871	41.0	1880
Do	San Diego	77.0	40.0	85.0	1873	38.0	1881
Colorado	Denver	63.0	6.0	76.0	1876, 1879	18.0	1877
Do	Pike's Peak	23.9	27.0	33.2	1885	38.0	1880
Connecticut	New Haven	70.2	34.0	71.5	1882	2.0	1875
Do	New London	66.3	26.5	72.0	1882	4.0	1875
Dakota	Fort Buford	57.5	10.0	62.0	1879	20.0	1881
Do	Yankton	70.4	0.0	76.0	1876	15.0	1875
Delaware	Del. Breakwater			73.0	1881	23.0	1880
Do	Cape Henlopen	74.0	35.6				
District of Columbia	Washington City	73.1	32.2	80.0	1879	12.5	1880
Florida	Jacksonville	81.9	35.5	84.0	1875, 1877	30.0	1873
Do	Key West	89.8	64.1	91.0	1876	52.0	1873
Georgia	Atlanta	75.2	27.9	80.5	1882	20.0	1881, 1883
Do	Savannah	78.0	35.0	82.0	1875	22.0	1872
Idaho	Boise City	58.3	9.4	70.0	1878	7.0	1880
Illinois	Chicago	74.2	24.6	80.5	1882	7.0	1872
Do	Chicago	68.8	16.4	72.0	1874, 1882	2.0	1872
Indiana	Indianapolis	71.6	16.5	75.0	1879	5.0	1880
Indian Territory	Fort Sill	76.9	19.0	84.0	1875	4.0	1880
Iowa	Dubuque	69.5	11.3	69.0	1874, 1879	9.0	1875
Do	Keokuk	69.4	15.2	74.0	1874	3.0	1872
Kansas	Dodge City	73.0	7.3	83.0	1875	7.0	1880
Do	Leavenworth	77.0	15.0	77.0	1874	0.0	1872
Kentucky	Louisville	75.1	21.7	78.0	1879	4.5	1872
Louisiana	New Orleans	82.2	34.4	84.7	1885	31.5	1881
Do	Shreveport	79.4	30.7	86.0	1882	18.0	1880
Maine	Eastport			64.0	1882	13.0	1875
Do	Portland	58.7	21.4	66.0	1882	6.0	1875
Maryland	Baltimore	73.2	26.0	78.0	1879	15.0	1880
Massachusetts	Boston	66.1	24.0	75.0	1882	2.0	1875
Michigan	Detroit	64.9	15.6	69.0	1879, 1882	0.0	1880
Do	Alpena	67.0	11.2	64.2	1885	4.0	1880
Minnesota	Duluth	61.0	4.3	65.0	1874	29.0	1875
Do	Saint Paul	73.6	3.3	73.0	1874	24.5	1875
Mississippi	Vicksburg	81.1	27.8	84.8	1885	23.0	1877, 1880
Missouri	Saint Louis	75.1	23.2	82.0	1879	5.0	1872
Montana	Fort Benton			71.6	1884	31.0	1880
Do	Helena	58.8	8.8	62.0	1884	17.0	1880
Nebraska	North Platte	66.7	5.0	79.0	1876	10.0	1877
Do	Omaha	73.1	9.1	74.0	1874	6.0	1875
Nevada	Winnemucca	58.7	0.6	70.8	1885	9.0	1880
New Hampshire	Mount Washington	45.3	1.8	51.0	1885	40.0	1875
New Jersey	Atlantic City	65.0	24.4	72.0	1882	10.0	1875
Do	Sandy Hook	68.9	29.0	73.0	1881	6.0	1880
New Mexico	Santa Fe	58.8	0.4	77.0	1877	11.0	1880
New York	Buffalo	62.0	21.4	68.3	1881	2.5	1875
Do	New York City	72.7	28.6	74.0	1882	7.0	1875
North Carolina	Charlotte	74.0	27.5	80.0	1879	18.0	1880
Do	Wilmington	77.4	29.7	83.0	1877, 1879	20.0	1872
Ohio	Cincinnati	72.8	18.1	75.8	1879	5.0	1880
Do	Cleveland	71.0	19.6	72.5	1882	0.0	1880
Oregon	Portland	57.8	25.6	68.0	1873	22.5	1880
Do	Roseburg	63.0	22.3	69.7	1884	17.5	1880
Pennsylvania	Pittsburgh	68.8	22.0	79.0	1876	4.0	1880
Do	Philadelphia	72.7	26.9	77.0	1876	8.0	1875
Rhode Island	Block Island	63.5	32.5	70.0	1881	19.0	1880
South Carolina	Charleston	78.0	34.9	82.0	1879	28.0	1873, 1881
Tennessee	Knoxville	72.5	23.7	80.5	1881	11.5	1872
Do	Nashville	73.6	22.7	80.6	1882	13.0	1873
Texas	Fort Davis	81.0	17.5	81.6	1883	6.0	1880
Do	Galveston	85.1	34.5	82.0	1875, 1876	29.0	1880
Utah	Salt Lake City	60.0	14.4	70.0	1882	3.0	1880
Virginia	Lynchburg	73.3	24.1	80.2	1882	13.0	1880
Do	Norfolk	74.8	29.7	80.0	1879	20.0	1872
Washington Ter.	Spokane Falls	53.8	5.4	60.0	1885	3.0	1881
Do	Olympia	57.5	27.0	63.0	1884	21.0	1882
Wisconsin	La Crosse	67.8	6.7	70.0	1874	21.0	1875
Do	Milwaukee	67.3	11.3	70.0	1874, 1882	14.0	1875
Wyoming	Cheyenne			69.0	1876	20.0	1875

Middle slope.—1st to 30th.

Southern slope.—2d to 6th, 8th, 9th, 11th to 21st, 23d to 29th.

Southern plateau.—1st to 5th, 8th to 11th, 13th to 30th.

Middle plateau.—1st to 30th.

Northern plateau.—1st to 19th, 21st, 22d, 24th to 30th.

North Pacific coast region.—1st to 23d, 25th to 30th.

Middle Pacific coast region.—1st to 7th, 10th, 12th, 13th, 14th, 16th to 19th, 20th to 30th.

South Pacific coast region.—Los Angeles, California, 1st, 2d, 3d, 13th, 16th, 17th, 18th, 19th, 22d, 23d, 24th; Poway, California, 17th to 21st, 23d, 24th, 25th; Cahuenga, California, 17th, 19th, 24th.

ICE.

Ice formed in the southern parts of the country, as follows:

Alabama.—Mobile, 18th; Montgomery, 26th, 28th.

Arizona.—Yuma, 20th.

California.—Los Angeles, 16th, 17th, 19th.

Florida.—Pensacola, 19th.

Georgia.—Forsyth, 7th, 8th, 9th, 14th, 26th to 29th.

Mississippi.—Vicksburg, 18th.

North Carolina.—Reidsville, 1st, 7th, 8th, 9th; Raleigh, 7th; Charlotte, 19th, 27th; Smithville, 8th, 19th.

New Mexico.—Gallinas Spring, 2d.

South Carolina.—Charleston, 8th, 9th; Spartanburg, 9th, 19th, 20th, 26th to 29th.

Tennessee.—Chattanooga, 7th, 8th, 9th, 14th, 18th, 19th, 26th, 28th; Nashville, 1st, 7th, 8th, 14th, 15th, 16th; Milan, 7th; Ashwood, 1st, 7th, 8th, 13th to 16th, 18th, 19th, 26th, 27th.

Texas.—Abilene and Fort Davis, 13th and 17th; Galveston, 17th; Corsicana, 13th, 16th, 17th, 18th, 20th, 25th, 26th, 27th.

TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

Temperature of water for November, 1886.

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.	Mean temperature of the air at station.
	Max.	Min.			
Alpena, Michigan	46.3	30.6	15.7	11.2	32.0
Augusta, Georgia	59.6	49.8	9.8	6.9	51.9
Baltimore, Maryland	59.6	45.0	14.6	12.3	46.4
Block Island, Rhode Island	59.4	45.5	10.9	8.1	46.6
Boston, Massachusetts	52.2	42.1	10.1	22.6	42.8
Buffalo, New York	53.0	33.7	19.3	14.3	37.3
Canby Fort, Washington Territory	53.0	46.0	3.3	14.8	45.6
Cedar Key, Florida	73.1	56.1	17.0	7.7	60.0
Charleston, South Carolina	66.9	56.7	10.2	37.3	57.1
Chincoteague, Virginia	69.4	46.2	23.2	3.1	50.0
Chicago, Illinois	48.4	32.3	15.9	8.1	38.2
Cleveland, Ohio	55.0	37.7	17.3	13.2	38.9
Detroit, Michigan	49.9	33.9	16.0	20.9	38.5
Duluth, Minnesota	45.1	35.7	9.4	10.7	27.8
Escanaba, Michigan	49.7	36.2	13.5	18.8	30.1
Galveston, Texas	70.4	51.2	19.2	14.4	62.0
Grand Haven, Michigan	49.6	32.2	17.4	18.2	35.4
Jacksonville, Florida	70.9	58.5	12.4	18.0	59.1
Key West, Florida	79.2	72.2	7.0	18.8	73.2
Marquette, Michigan	52.1	34.0	18.1	9.8	34.6
Macon, Fort, North Carolina	65.7	39.6	26.1	14.7	35.2
Marquette, Michigan	49.4	35.9	13.5	11.0	30.4
Mobile, Alabama	68.5	59.5	9.0	16.6	56.1
New London, Connecticut	57.6	47.0	10.6	11.5	44.4
New York City	56.6	46.8	9.8	15.4	45.3
Norfolk, Virginia	60.3	49.3	11.0	15.9	51.2
Pensacola, Florida	76.0	55.1	20.9	17.3	58.7
Portland, Maine	49.1	41.9	7.2	10.7	38.7
Portland, Oregon	49.6	40.1	9.5	48.8	41.6
Sandusky, Ohio	50.0	34.1	15.9	10.0	38.2
San Francisco, California	56.0	52.1	3.9	38.3	55.1
Savannah, Georgia	68.3	52.6	15.7	10.2	58.0
Toledo, Ohio	50.0	33.9	16.1	12.2	36.6
Wilmington, North Carolina	59.6	51.9	4.7	8.3	55.3

* Record for 27 days.

† Record for 23 days.

PRECIPITATION.

[Expressed in inches and hundredths.]

The distribution of rainfall over the United States and Canada for November, 1886, as determined from the reports of about five hundred and eighty stations, is exhibited on chart iii.

The precipitation of the month is above the normal in New England, New York, Pennsylvania, New Jersey, Delaware, Maryland, the Ohio Valley, Tennessee, Arkansas, and the northern portion of the east Gulf States; it is also excessive in Minnesota, Dakota, Montana, and the upper part of the Missouri Valley; in all other districts it is deficient. The departures in excess of the normal are nowhere very large; the greatest occur in Tennessee and the Ohio Valley; one station, Memphis, gives an excess 4.46; the departures in the extreme northwest are small, averaging 0.68. The rainfall of the Pacific coast has been very small, and large deficiencies occur in this region; they are especially large in the southern part of Washington Territory and in northern Oregon. Over the extreme northwestern point of Washington Territory the precipitation is unusually large, 11.80 falling at Neah Bay, and 10.44 at

Tatoosh Island. The rainfall of California is notably small for November; at Sacramento it is only one-eleventh and at San Francisco about one-fourth of the normal. The deficiencies are also large in Texas and along the Atlantic coast from the Chesapeake Bay southward to Key West, Florida; at Palestine, Texas, the rainfall is 4.11, and at Galveston, Texas, 2.36 below the normal. Numerous reports of the evil effects of the long drought that has prevailed during the summer and autumn months continue to come from that state.

The following are some of the most marked departures from the normal precipitation at Signal Service stations:

Above normal.		Below normal.	
	Inches.		Inches.
Memphis, Tennessee	4.45	Portland, Oregon	6.17
Montgomery, Alabama	3.16	Olympia, Washington Territory	5.90
Knoxville, Tennessee	3.90	Hatteras, North Carolina	4.50
Albany, New York	3.72	Fort Canby, Washington Territory	4.33
Buffalo, New York	3.62	Palestine, Texas	4.11
Pittsburg, Pennsylvania	3.45	Kitty Hawk, North Carolina	3.81

In the following table are shown, for the several geographical districts, the normal precipitation for November; the average for November, 1886, and the excess or deficiency as compared with the normal:

Average precipitation for November.

Districts.	Average for Nov., Signal-Service ob- servations.		Comparison of Nov., 1886, with the aver- age for several years.
	For sev- eral years.	For 1886.	
	Inches.	Inches.	Inches.
New England	3.94	4.56	+ 0.62
Middle Atlantic States	3.43	3.91	+ 0.48
South Atlantic States	3.58	1.43	- 2.15
Florida Peninsula	2.16	0.62	- 1.54
Eastern Gulf States	4.86	4.75	- 0.11
Western Gulf States	4.50	3.27	- 1.23
Rio Grande Valley	1.54	0.96	- 0.58
Tennessee	4.36	6.82	+ 2.46
Ohio Valley	3.39	4.01	+ 0.62
Lower lake region	3.61	4.65	+ 1.04
Upper lake region	2.62	2.57	- 0.05
Extreme northwest	0.78	1.47	+ 0.69
Upper Mississippi Valley	2.44	2.39	- 0.05
Missouri Valley	1.21	1.56	+ 0.35
Northern slope	0.64	1.09	+ 0.45
Middle slope	0.58	0.52	- 0.06
Southern slope	1.20	0.25	- 0.95
Southern plateau	0.61	0.48	- 0.13
Middle plateau	1.28	1.30	+ 0.02
Northern plateau	1.59	1.07	- 0.52
North Pacific coast region	6.86	3.46	- 3.40
Middle Pacific coast region	2.77	0.71	- 2.06
South Pacific coast region	0.79	0.79	0.00

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of November for a series of years, the precipitation for November, 1886, and the departures from the average:

Station.	County.	Average pre- cipitation for Nov.	Number of years.	Precipitation for Nov., 1886.	Departure.
		Inches.		Inches.	Inches.
Lead Hill	Arkansas	4.10	5	3.49	- 0.61
Sacramento	California	3.11	21	0.11	- 3.00
Canton	Connecticut	4.70	25	5.37	+ 0.67
Hartford	Hartford	3.61	15	5.60	+ 1.99
Middletown	Middlesex	3.99	26	4.33	+ 0.41
New Haven	New Haven	3.95	14	3.83	- 0.12
Wallingford	New Haven	3.89	28	4.68	+ 0.79
Weibster	Dakota	1.25	4	4.33	+ 3.08
Archer	Florida	1.76	4	1.08	- 0.68
Anna	Illinois	4.31	11	6.65	+ 2.34
Mattoon	Coles	3.70	6	2.65	- 1.05
Peoria	Peoria	2.37	30	1.34	- 1.03
Riley	McHenry	2.08	26	0.98	- 1.04
Sandwich	De Kalb	2.79	35	1.47	- 1.32
Sycamore	De Kalb	3.00	6	0.96	- 2.04

Deviations from average precipitation—Continued.

Station.	County.	Average pre- cipitation for June.	Number of years.	Precipitation for June, 1886.	Departure.
		Inches.		Inches.	Inches.
Lafayette	Indiana	3.70	7	1.87	- 0.83
Logansport	Cass	2.91	31	3.71	+ 0.80
Vevay	Switzerland	3.08	21	4.54	+ 1.46
Cresco	Iowa	1.47	14	1.86	+ 0.39
Monticello	Jones	2.46	33	1.35	- 1.11
Independence	Kansas	2.04	14	1.70	- 0.34
Wellington	Sumner	1.06	8	0.10	- 0.96
Yates Centre	Woodson	1.77	6	1.34	- 0.43
Cornish	Maine	3.73	29	4.78	+ 1.05
Gardiner	Kennebec	4.49	48	5.97	+ 1.48
Orono	Penobscot	4.42	18	5.57	+ 1.15
Fallston	Maryland	3.60	16	4.19	+ 0.59
Amherst	Massachusetts	3.80	52	4.72	+ 0.92
Cambridge	Middlesex	3.92	46	3.91	- 0.01
Chestnut Hill	Middlesex	4.45	11	4.03	- 0.42
Framingham	Middlesex	3.98	12	4.47	+ 0.49
Lake Cochituate	Middlesex	4.51	35	4.76	+ 0.25
Lowell	Middlesex	3.88	62	5.10	+ 1.22
Lynn	Essex	4.10	12	3.96	- 0.14
Mystic Lake	Middlesex	3.96	11	4.07	+ 0.11
Somerset	Bristol	4.45	16	4.49	+ 0.04
Springfield	Hampden	3.85	39	4.77	+ 0.92
Waltham	Middlesex	4.28	62	4.02	- 0.26
Carson City	Nevada	1.10	8	0.44	- 0.66
Saint John	New Brunswick	5.65	26	6.16	+ 0.51
Antrim	New Hampshire	4.71	15	6.15	+ 1.44
Concord	Hillsborough	3.49	31	3.81	+ 0.32
Hanover	Merrimack	2.51	20	4.94	+ 2.43
Palermo	New York	3.94	33	4.31	+ 0.37
Wauseon	Ohio	3.08	14	2.66	- 0.42
Westerville	Fulton	2.83	12	3.22	+ 0.39
Dyberry	Pennsylvania	3.12	16	7.10	+ 3.98
Kirkwood	South Carolina	2.47	20	0.92	- 1.55
Stateburg	Sumter	2.05	6	0.87	- 1.18
New Ulm	Texas	5.41	15	1.50	- 3.91
Lunenburg	Vermont	3.23	38	3.45	+ 0.22
Newport	Essex	3.66	11	7.80	+ 4.14
Strafford	Orange	3.58	12	4.97	+ 1.39
Bird's Nest	Virginia	2.22	18	2.75	+ 0.53
Dale Enterprise	Northampton	1.75	6	6.46	+ 4.71
Variety Mills	Rockingham	2.18	8	3.81	+ 1.63
Helvetia	Nelson	3.90	10	4.53	+ 0.63

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are furnished by voluntary observers:

Illinois.—Riley, McHenry county: the total precipitation of the autumn of 1886, 5.78, is 3.82 less than the average of the past twenty-five years; two autumns only during that time have had less precipitation, viz., 1867 and 1869.

Indiana.—Logansport, Cass county: snow and total precipitation comparisons for November during the past thirty-one years: greatest snowfall, 18.5 inches, in 1874; least, 0.1 inch, in 1865; normal depth of snowfall, 4.9 inches; no snow fell during the month in 1860, 1861, and 1883. Greatest precipitation, 6.29 in 1864; least, 0.41, in 1865.

Vevay, Switzerland county: during the past twenty-one years the largest November precipitation, 5.73, fell in 1883; the least, 0.73, in 1872. The largest total snowfall for November, 15.0 inches, occurred in 1880; the least, 0.1 inch, in 1868. No snow fell in November, 1865, 1866, 1867, 1875, 1877, 1878, 1879, 1883, and 1885; the snowfall for November, 1886, 3.2 inches, is 1.2 above the average.

Spiceland, Henry county: during the past thirty-three years the greatest November precipitation, 6.00, occurred in 1864; the least, 0.60, in 1872.

Iowa.—Monticello, Jones county: the snowfall for November, 1886, 2.2 inches, is 1.3 inches below the average of the past thirty-three years; the largest snowfall for November, 16.1 inches, occurred in 1869; the largest precipitation, 5.29, in 1879; the least, 0.12, in 1869.

Kansas.—Yates Centre, Woodson county: the precipitation of the autumn of 1886, 6.35, is 3.28 below the average of the past six years.

Wellington, Sumner county: the precipitation of the present month, 0.10, is less than that of any November during the past eight years.

Maryland.—Fallston, Harford county: during the past sixteen Novembers the greatest precipitation, 10.27, occurred in 1877; the least, 0.45, in 1882.

Massachusetts.—Worcester, Worcester county: the precipitation for the month aggregated 5.19 inches of rain and melted snow, and .04 inch of snow, against 5.96 inches of rain and melted snow during the corresponding period in

1885. The aggregate rainfall, including melted snow, for the eleven months of 1886 is 45.87 inches against 40.23 inches during the same period last year. The rainfall thus far this year is nearly 6 inches greater than the average yearly rainfall in New England.

New York.—Palermo, Oswego county: during the past thirty-three years the largest snowfall for November, 39.2 inches, occurred in 1880; the least, 2.0 inches, in 1877; the snowfall of the present month, 24.2 inches, is 4.8 below the average.

Ohio.—Westerville, Franklin county: the largest November precipitation during the past twelve years, 4.55, occurred in 1881; the least, 1.08, in 1884.

Wauseon, Fulton county: the total snowfall of the month, 3.6 inches, is 2.6 inches less than the average of the past fourteen years; the largest November snowfall, 15.7 inches, occurred in 1874; the least, 0.8 inch, in 1883. The greatest amount of precipitation for November, 5.83, occurred in 1881; the least, 1.46, in 1884.

Pennsylvania.—Dyberry, Wayne county: the precipitation of the month, 7.10, is greater than that of any other month during the past sixteen years, except August, 1885, 8.77; July, 1882, 7.24; and July, 1871, 7.68.

Texas.—New Ulm, Austin county: the total precipitation of the autumn of 1886, 3.41, is 1.72 inches below the average of the past fifteen years.

Virginia.—Dale Enterprise, Rockingham county: during the past six years the greatest precipitation in November, 6.46, occurred in 1886; the least, 0.52, in 1882.

Variety Mills, Nelson county: during the past eight years the greatest November precipitation, 4.63, occurred in 1880; the least, 0.59, in 1882.

West Virginia.—Helvetia, Randolph county: during the past ten years the largest November precipitation, 7.98, occurred in 1878; the least, 2.05, in 1883.

Table of excessive and greatest monthly precipitation for November, 1886.

Station.	Specially heavy.		Largest monthly.	Amount.	Station.	Specially heavy.		Largest monthly.	Amount.
	Date.	Amt.				Date.	Amt.		
Alabama.					Ohio—Con.				
Mount Vernon	23, 24	3.45	7.03		College Hill	16, 17	2.00		
Montgomery	24	2.02	6.72		Jacksonborough	16, 17	2.00		
Connecticut.					Pennsylvania.				
Hartford			6.32		York	12, 13	3.00	9.50	
Voluntown	6, 7	2.10			Do	17	2.00		
Dakota.					Do	26	3.00		
Webster	29, 30	2.48			Dyberry			7.10	
Illinois.					Blooming Grove	25, 26	2.20	7.00	
Anna	16, 17	2.67	6.65		Drifton			6.52	
Indiana.					Wellsborough	17, 18	3.65	6.50	
Butterville	17	2.35			Do	23	2.60		
Mauzy	17	2.30			Erie			6.21	
Columbus	17	2.25			Zionsville			6.06	
Princeton	17	2.30			Gramplan Hills			6.03	
Connersville	17	2.48			Tennessee.				
Greenfield	17	2.20			Memphis	21	3.24	8.89	
Farmland	17	2.30			Milan	16, 17	2.20	8.65	
Brookville	17	2.25			Do	20, 21	2.05		
Indianapolis	16, 17	2.44			Covington	21	3.90	8.58	
Kentucky.					Riddleton	17	2.87	8.15	
Frankfort	23	2.08	6.18		Do	22	2.65		
Louisiana.					Bolivar	16	3.30	8.02	
New Orleans	23, 24	2.35			Do	21	3.67		
Maine.					McKenzie			8.00	
Orono	6, 7	4.58	8.67		Manchester	17	3.60	7.97	
Do	17, 18	2.25			Trenton			7.73	
Gardiner			6.05		Woodstock	21	3.15	7.35	
Massachusetts.					Knoxville	23, 24	2.25	7.21	
Williamstown	24, 25	2.27			Howell	17	2.20	6.50	
Michigan.					Beech Grove	17	2.65	6.43	
Alpena	17, 18	2.32			Austin	16, 17	2.00	6.36	
Mississippi.					Do	21, 22	2.50		
Vicksburg	16, 17	2.30			Rogersville			6.36	
Missouri.					Farmingdale	17	3.37	6.33	
Centerville	11	2.40			Andersonville	22, 23	2.21	6.28	
New Hampshire.					Sailor's Rest	21, 22, 23	4.31	6.26	
Mt. Washington	18	2.02	6.48		Savannah	21	2.18	6.17	
Bristol			6.38		Careyville			6.10	
Antrim	17, 18	2.00	6.15		Greenville	21	2.10		
Woodstock	17, 18	2.52	6.13		Jonesborough	22, 23, 24	4.41		
Ashland			6.11		Fostoria	21	2.70		
New Jersey.					Cookeville	17	2.00		
Clayton	18	2.00			Florence Station	17	2.22		
New York.					Hurricane Switch	17	2.41		
Auburn	14, 15	2.12	6.89		Dyersburg	21	2.00		
Humphrey			6.23		Vermont.				
Buffalo			6.05		Newport			7.80	
Ithaca			6.03		Poultney	26	2.09	7.75	
North Carolina.					Post Mills	17	2.80	6.45	
Fiat Rock	18	3.12	8.51		Virginia.				
Do	24, 25	2.66			Dale Enterprise			6.46	
Statesville	25	2.79			Washington Ter.				
Lenoir	25	3.80			Neah Bay	28, 29	3.65	11.80	
Lincolnton	24, 25	2.04			Tatoosh Island	26 to 29	5.67	10.44	
Ohio.					West Virginia.				
West Milton			6.00		Helvetia	6, 7	3.00		
Ruggles	16, 17	2.40							

SNOW.

North Platte, Nebraska: a snow storm set in at 6.45 p. m. of the 15th and continued until 8.45 p. m. of the 16th, the storm was accompanied by high northerly winds, attaining

during the day a velocity of forty miles per hour, and drifting the snow in places to a depth of six or eight feet. This was an unusually severe storm, and, on account of the high wind and low temperature, caused much suffering; a large number of cattle and sheep perished. Business was entirely suspended and trains were delayed for two days.

Genoa, Nance county, Nebraska: on the night of the 15-16th a violent storm of wind and snow set in and continued until the morning of the 17th. The wind blew violently from the southeast, drifting the snow and blockading the roads. This snow storm was more severe than any other that has occurred in November for several years.

Dubuque, Iowa: light snow fell on the 16th and 17th and heavy snow on the 18th until 3.30 p. m., when the sky began clearing. This storm was very severe north and west of Dubuque and all trains arrived several hours late.

Saint Paul, Minnesota: during the 17th the barometer fell rapidly and high northerly winds prevailed, with light snow, until 11.20 a. m. From 1.30 a. m. until midnight the snow drifted badly and street-car travel was entirely suspended in Saint Paul and Minneapolis. Much delay to railway trains was reported, the greatest trouble was to the southward, where trains were delayed from two to eight hours on account of the heavy snow. During the night of the 17-18th the wind continued to blow hard from the north and northwest; maximum velocity, twenty-nine miles per hour, shortly after 1 a. m.

Omaha, Nebraska: during the 16th, 17th, and 18th light and heavy snow fell to a depth of fourteen inches; on the 17th it was accompanied by high wind which formed large drifts and filled railroad cuttings, delaying all trains.

Huron, Dakota: light snow fell on the 21st from 9.50 p. m. until after midnight, when heavy rain, accompanied by brisk northeasterly winds, set in. At 7.30 p. m. of the 18th snow again began falling, accompanied by a heavy gale from the southwest, veering to west and northwest, and blowing steadily at an average velocity of thirty-seven miles per hour all night; maximum velocity forty-two miles per hour. This storm was very severe over the surrounding country, and several deaths from exposure were reported.

Bismarck, Dakota: light snow fell during the night of the 21st-22d; on the 22d it fell heavily and was accompanied by high northeasterly winds which attained a maximum velocity of thirty-eight miles per hour between 1 and 2 p. m.; at 9 p. m. the wind backed to north and blew at the rate of twenty-five miles per hour. The heavy snow continued until 9 a. m. of the 23d, and the high wind still prevailed, blowing from the northwest; maximum velocity, thirty-two miles per hour, at 10.40 a. m. The high wind which prevailed during this storm drifted the snow to a great depth, in some railroad cuts the track was covered to a depth of twenty-five or thirty feet. This "blizzard" extended all over Dakota and into Montana; in the neighborhood of Glendive, in Montana, many cattle perished.

The dates on which snow fell in the various districts are as follows:

New England.—7th to 14th, 17th to 21st, 23d, 25th to 30th.

Middle Atlantic states.—4th, 6th to 16th; 19th, 20th, 25th to 30th.

South Atlantic states.—7th, 9th, 25th.

West Gulf states.—Lead Hill, Arkansas, 12th, 17th; Fort Gibson, Indian Territory, Little Rock and Fort Smith, Arkansas, Shreveport, Louisiana, Palestine and Corsicana, Texas, 17th; Grand Coteau, Louisiana, 18th to 21st.

Tennessee.—9th, 17th, 18th, 19th.

Ohio Valley.—5th, 6th, 7th, 9th, 11th, 12th, 13th, 17th, 18th, 25th, 26th, 27th, 29th, 30th.

Lower lake region.—4th, 6th to 16th, 18th to 21st, 24th to 30th.

Upper lake region.—1st, 2d, 4th to 11th, 13th, 16th to 30th.

Extreme northwest.—4th, 5th, 17th, 20th to 23d, 25th to 30th.

Upper Mississippi valley.—5th, 6th, 12th, 15th to 18th, 21st to 30th.

Missouri Valley.—5th, 6th, 10th, 11th, 12th, 15th to 19th, 21st to 30th.

Northern slope.—1st, 2d, 4th, 5th, 8th, 11th, 14th to 17th, 19th to 26th, 28th, 29th, 30th.

Middle slope.—1st, 3d, 5th, 7th to 12th, 15th, 16th, 17th, 19th, 21st to 24th, 29th, 30th.

Southern slope.—Fort Stanton, New Mexico, 17th, 22d.

Southern plateau.—8th, 9th, 13th, 16th to 22d, 24th.

Middle plateau.—1st, 2d, 6th, 8th to 24th.

Northern plateau.—4th, 6th, 8th, 9th, 12th, 14th to 24th, 30th.

North Pacific coast region.—11th, 14th, 18th to 23d, 27th.

Middle Pacific coast region.—3d, 5th, 6th, 21st.

MONTHLY SNOWFALLS.

[Expressed in inches and tenths.]

The following stations report monthly snowfalls of one inch or more:

Arizona.—Prescott, 8.3; Fort Apache, 4.2; Willcox, 2.

California.—Fort Bidwell, 8.5; Boca, 7; Emigrant Gap, 4; Hot Springs, 3.

Colorado.—Montrose, 13; Denver, 9.8; Pike's Peak, 6.6; Las Animas, 4.9.

Connecticut.—North Colebrook, 7.5.

Dakota.—Yankton, 29.8; Deadwood, 28.8; Vermillion, 22; Fort Yates, 15.8; Richardton, 15; Webster, 13; Bismarek, 11; Fort Totten, 7.3; Huron, 3.2.

Idaho.—Boisé City, 2.1.

Illinois.—Flora, 17.5; Palestine, 17.2; Martinsville and Sumner, 17; Windsor, 12.5; Fairfield, 12; Mascoutah, 10.7; Eberle, McLeansborough, Vandalia, and Richview, 10; Greenville, 8; Carlyle, 7.5; Charleston, 7.1; Philo and Jerseyville, 7; Erwin, 6.8; Payson, 6.3; Mattoon, White Hall, and Mount Carmel, 6; Oneida and Bluffdale, 5.5; Springfield, 5.2; Camden, 5; Atwood, 4; Makanda, 3.5; Lake Forest and Melvin, 3; Chicago, 2.6; Anna, 2.3; Decatur, 2.2; Griggsville, 2.1; Pekin, Marengo, Rockford, Riley, Sycamore, Shawneetown, and Peoria, 2.

Indiana.—Princeton, 18.5; Worthington, 14; Columbus and Sanman, 10.6; Blue Lick, 10.2; Butlerville, 10; Farmland, 7.5; Spiceland, Franklin, and Mauzy, 7; Brookville, 6; Indianapolis, 5.8; Jeffersonville, 5.3; Degonia, Richmond, and Logansport, 5; Connersville, 4.8; Marengo and Laconia, 4; Terre Haute and La Grange, 3.5; Vevay, 3.2; Marion, 2.

Iowa.—Des Moines, 16; Bancroft, 13; Cresco, 8.5; Oskaloosa, 6.5; Keokuk, 6.4; West Point, 6.2; Dubuque, 4.7; Cedar Rapids a, 4.6; Independence, 4; Muscatine, 3.3; Monticello, 2.2; Cedar Rapids b, 2.

Kansas.—Allison, 10.5; Dodge City, 4.2; Globe, 3; Salina, 2.5; El Dorado, 2.

Kentucky.—Louisville, 3.1; Richmond, 2.4.

Maine.—Cornish, 14; Orono, 6; Gardiner, 3.8.

Massachusetts.—Dudley, 5; Blue Hill Observatory, Princeton, Westborough, and Williamstown, 2.

Michigan.—Marquette, 35.7; Traverse City, 23.5; Mackinaw City, 18.9; Alpena, 15.4; Escanaba, 13; Thornville, 10.5; Harrisville, 8.1; Mottville, 7; Kalamazoo, 5.6; Lansing, 4.8; Grand Haven, 4.1; Hudson, 3.7; Port Huron, 2.

Minnesota.—Duluth, 24; Minneapolis, 23.5; Red Wing, 21.5; Moorhead, 20.8; Mankato, 20.6; Saint Paul, 19.6; Rochester, 18; Spring Valley, 17.8; Albert Lea, 15.5; Eau Claire, 15; Northfield, 13; Excelsior, 11.5; Winona, 11; Park Rapids, 9.5; Morris, 8; Bird Island, 7.5; Saint Vincent, 7; Alexandria, 4.5.

Missouri.—Saint Louis, 4; Centreville, 2.2.

Montana.—Fort Maginnis, 13.6; Poplar River, 9.2; Fort Assinaboine, 8.4; Helena, 4.9; Fort Custer, 3.2.

Nebraska.—Hay Springs, 20; De Soto, 17.4; Omaha, 15.7; Lincoln, 15; Fremont, 14.5; North Platte, 14.3; Weeping Water, 14; Genoa, 13.5; Syracuse, 13; Minden, 12.8; Vick, 12; Ashland, 10.5; Brownville, 9.4; Marquette, 8.2; York, 8; Valentine, 6.2; Crete, 5.5; De Witt, 5; Stockham, 4.

Nevada.—Battle Mountain and Toano, 13.5; Palisade, 12.5;

Halleck, 11.5; Carlin, 8.5; Beowawe, 8; Winnemucca, 6.8; Elko and Humboldt, 6; Wells, 5; Otego, 4.5; Carson City, 2.8; Galconda, 2.1.

New Hampshire.—Antrim, 7; Nashua, 2.

New Mexico.—Santa Fé, 2.3; Fort Stanton, 2.2.

New York.—Oswego, 34.3; Le Roy, 32.9; Cooperstown and Ithaca, 32; Humphrey, 29; Factoryville, 28.8; Buffalo, 27.3; Palermo, 24.2; Auburn, 24; Albany, 22.3; Rochester, 22.2; Penn Yan, 19; Menand Station (near Albany), 13.2.

Ohio.—Garrettsville, 22.3; Cleveland, 15.3; Hiram, 19.5; Ruggles, 11; Jacksonborough, 8; Columbus, 6.9; College Hill and North Lewisburg, 6.5; Yellow Springs, 6; West Milton, 5.5; Westerville, 5.6; Tiffin a, 4.5; Wauseon, 3.6; Tiffin b, 3.5; Napoleon, 3.

Oregon.—Lakeview, 7.2; Fort Klamath, 4.5.

Pennsylvania.—Wellsborough, 37.2; Dyberry, 34; Grampian Hills and Phillipsburg, 24; Erie, 18.5; Drifton, 11; Wilkesbarre, 9; Catawissa, 8.4; Blooming Grove, 3.5.

Utah.—Salt Lake City, 27.8; Frisco, 19.3; Corinne, 13; Ogden, 11.8; Blue Creek, 10; Promontory, 6.8; Terrace, 2.5.

Vermont.—Poultney, 49; Newport, 34.4; Charlotte, 32; Burlington, 30; Strafford, 27; Lunenburg, 24.5; Post Mills, 20.5; Brattleborough, 15.6.

Washington Territory.—Fort Spokane, 8.1.

West Virginia.—Helvetia, 15; Parkersburg, 2.9.

Wisconsin.—Wausau and Embarras, 18; Green Bay, 12.1; La Crosse, 7.4; Manitowoc, 6.8; Milwaukee, 6.2; Fond du Lac, 6; Delavan, 3.1; Beloit, 3; Prairie du Chien, 2.5; Madison, 2.

Wyoming.—Fort Bridger, 21.2; Fort Laramie, 15.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

Arizona.—Fort Grant, 0.2.

Colorado.—Pike's Peak, 1.

Dakota.—Yankton, 13; Fort Totten, 7; Deadwood, 6; Bismarek, 4; Huron, 3; Fort Buford, 2.

Illinois.—Springfield, 4; Chicago, 0.5.

Indiana.—Indianapolis, 0.7.

Iowa.—Keokuk, 6.2; Dubuque, 4.

Kentucky.—Louisville, 2.

Michigan.—Marquette, 8; Mackinaw City, 6; Alpena, 4; Grand Haven and Escanaba, 3; Port Huron, 0.7.

Minnesota.—Duluth, 16; Moorhead, 12; Saint Paul, 10; Saint Vincent, 6.

Missouri.—Saint Louis, 2.5.

Montana.—Poplar River, 5; Fort Maginnis, 1.5; Fort Custer, trace.

Nebraska.—Stromsburg, 11; De Soto, 6; Fremont, 4; Omaha and Hay Springs, 2; Valentine, trace.

New York.—Albany, 6; Oswego, 3; Buffalo and Rochester, 0.5.

Ohio.—Sandusky, Toledo, and Cleveland, trace.

Pennsylvania.—Pittsburg, 1; Erie, 0.5.

Utah.—Salt Lake City, 1.3.

Wisconsin.—Green Bay, 7; La Crosse, 6; Milwaukee, 2.

Wyoming.—Fort Bridger, 0.6.

HAIL.

New Haven, Connecticut: during the afternoon of the 30th a thunder-storm, accompanied by hail and brisk wind, occurred; the hail-stones varied in size from that of a pea to a marble.

Lynchburg, Virginia: a light thunder-storm, moving from west to east, passed over the town between 1.15 and 2.30 p. m. of the 30th; the storm was accompanied by heavy hail and light rain.

Hail also fell on the following dates:

Arizona.—Fort Verde, 1st.

Dakota.—Fort Sisseton, 22d; Fort Randall, 29th.

Illinois.—Cairo, 23d.

Indiana.—Vevay, 12th.

Kentucky.—Richmond, 9th.

Maine.—Kent's Hill, 12th; Cornish, 25th.
Massachusetts.—Amherst, 7th; Westborough, 13th.
Nebraska.—Valentine and Fort Robinson, 1st; Hay Spring, 2d, 5th.
New Jersey.—Beverly, 18th, 25th.
New York.—Setauket, 13th, 30th.
North Carolina.—Lenoir, 9th; Reidsville, 30th.
Ohio.—College Hill and Jacksonborough, 9th; Elyria, 6th.
Oregon.—Astoria, 8th, 20th; Albany, 17th.
Pennsylvania.—Wellsborough, 4th, 29th; Dyberry, 17th, 25th; Wilkesbarre, 18th; Blooming Grove, 25th.
Tennessee.—Nashville, 6th.
Utah.—Salt Lake City, 9th.
Virginia.—Chincoteague, 6th.
Washington Territory.—Walla Walla, 8th, 19th; Pysht, 17th; Neah Bay, 17th, 20th; Tatoosh Island and Bainbridge Island, 20th.
Wyoming.—Fort Laramie, 1st.
Wisconsin.—Embarras, 17th, 28th.

SLEET.

Sleet occurred in the various states and territories, as follows:

Connecticut.—Bethel, 10th.
Dakota.—Fort Meade, 4th; Fort Sully, 29th.
Idaho.—Boisé City, 9th, 20th.
Indiana.—Vevay, 9th.
Iowa.—Independence, 18th; Des Moines, 29th.
Kansas.—El Dorado, Emporia, and Globe, 11th.
Maine.—Cornish, 17th; Eastport, 17th, 18th.
Maryland.—Emmitsburg, 6th, 9th.
Massachusetts.—Deerfield, 7th; Worcester, 17th, 18th.
Michigan.—Kalamazoo, 10th.
Nebraska.—Tecumseh, 16th.
New Jersey.—Dover, 25th.
New York.—Oswego, 4th, 6th, 15th, 18th; Albany, 17th, 25th, 30th; West Point, 12th.
North Carolina.—Flat Rock, 9th.
Ohio.—Wauseon, 9th, 29th; Yellow Springs, 9th.
Oregon.—Linkville and Roseburg, 20th; East Portland, 22d.
Pennsylvania.—Pittsburg, 15th; Zionsville, 18th, 25th; Catawissa, 25th.
South Carolina.—Spartanburg, 9th.
Washington Territory.—Walla Walla, 24th.

WINDS.

The most frequent directions of the wind during November, 1886, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous meteorological data. In the Lake region the prevailing direction of the wind was from the west; in the middle Atlantic states and Missouri Valley, from the northwest; in the south Atlantic states, from the west or northwest. In other portions of the country the winds were variable.

HIGH WINDS.

[In miles per hour.]

Wind-velocities of fifty or more miles per hour were recorded during the month, as follows:

Mount Washington, New Hampshire, 54, se., 26th; 70, nw., 7th; 80, nw., 8th; 75, nw., 9th; 70, e., 13th; 99, nw., 14th; 98, nw., 15th; 83, nw., 16th; 94, sw., 17th; 84, sw., 18th; 66, nw., 19th; 70, w., nw., 20th; 54, w., 22d; 94, sw., 23d; 88, nw., 24th; 81, w., 26th.
 Pike's Peak, Colorado, 62, nw., 4th; 60, nw., 5th; 56, w., 6th; 56, nw., 8th; 64, w., 9th; 52, ne., 17th; 60, ne., 18th; 79, w., 19th; 86, w., 20th; 68, w., 21st; 76, w., 23d.
 Bismarck, Dakota, 53, nw., 4th.
 Fort Totten, Dakota, 64, nw., 4th.
 Cape Henry, Virginia, 60, w., 6th.
 Sandy Hook, New Jersey, 52, nw., 7th; 54, e., nw., 13th; 60, ne., 25th; 50, w., 26th.
 Fort Elliott, Texas, 50, nw., 16th.
 Marquette, Michigan, 53, e., 17th.

Mackinaw City, Michigan, 53, e., 17th.
 Block Island, Rhode Island, 52, sw., 18th.
 Buffalo, New York, 58, sw., 18th.
 Grand Haven, Michigan, 52, sw., 18th.
 Fort Maginnis, Montana, 52, nw., 27th.

LOCAL STORMS AND TORNADOES.

Chincoteague, Virginia: on the afternoon of the 6th a severe thunder-storm passed over this station, coming from the west. Rain began at 6.30 p. m.; total precipitation during the storm 1.02 inches. Hail began at 9.30 p. m. and continued until 9.50 p. m. At 9.27 p. m. the wind suddenly shifted to the west and blew at the rate of forty-five miles per hour.

Cape Henry, Virginia: a heavy thunder-storm from the northwest, accompanied by intense lightning and heavy rain, passed over this place between 9 and 11 p. m. of the 6th. During the storm a gale prevailed, the wind attaining at 9.45 p. m. a velocity of sixty miles per hour.

Bangor, Maine: a very heavy thunder-storm occurred here on the night of the 6-7th, the rainfall was large and the wind high, the electrical part of the storm was unusually intense for the season of the year. One dwelling was struck by lightning and slightly damaged, as well as several barns one of which was burned. The high wind also did considerable damage, blowing down fences, trees, and in the agricultural fair grounds, several buildings.

Keeler, California: a destructive wind occurred at 9 p. m. of the 14th at Panamint, Inyo county, wrecking a nearly completed quartz mill owned by the Surprise Mining and Milling Company. During the 14th the wind had been blowing a moderate gale from the southwest, which had not abated at the time of the disaster. At 9 p. m. a "secondary" wind from east set in, producing a violent whirlwind lasting about ten minutes, which completely demolished the south end of the mill. The studding, rafters, floor timbers, etc., were reduced to splinters, and the roof of corrugated iron was broken into fragments. The whole south side of the building was raised into the air, and the ground to the southwest for a distance of over one fourth of a mile was strewn with fragments.

Chambersburg, Franklin county, Pennsylvania: on the morning of the 17th a heavy rain storm set in and continued throughout the day; after sunset the wind began blowing a gale and continued to increase in force until 7 a. m. of the 18th, when it moved with the velocity of a high gale, blowing down chimneys, shutters, and houses. The greatest damage was done in the surrounding country, where numerous dwellings, school-houses, and barns were demolished and trees and fences blown down. In some parts of the county this storm exhibited, in the black whirling clouds which accompanied it and the direction in which the debris was scattered, the characteristics of a tornado.

Mobile, Alabama: at 10.50 a. m. of the 17th a thunder-storm, with light rain and high wind from the southeast, set in. At 1.45 p. m. the wind changed almost instantly from southeast to west, and blew for five minutes at the rate of fifty miles per hour, accompanied by unusually heavy thunder, lightning, and rain. Many branches of trees were broken off, and numerous out-houses, sheds, and fences were blown down, but no serious damage occurred. From 3 to 11 p. m. the barometer rose rapidly.

Wilkesbarre, Luzerne county, Pennsylvania: between 8 and 9 a. m. of the 18th a very high wind, which exhibited some of the characteristics of a tornado, passed over this county. Many substantial buildings were moved from their foundations and numerous light structures were completely destroyed. At Parsons, a small mining town three miles north of Wilkesbarre, two churches were damaged and several coal breakers partially destroyed, entailing a loss of \$10,000. The high school building in the town of Miner's Mill was badly wrecked, and in Kingston a church in course of construction was totally destroyed. Throughout the surrounding country farmers suffered severe loss, their barns and fences being blown down and orchards destroyed.

Table of miscellaneous meteorological data for November, 1886—Signal Service observations.

Stations.	Elevation above level.	Atmospheric pressure (in inches and hundredths).						Temperature of the air (in degrees Fahrenheit).										Winds.															
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.			Monthly mean.	Departure from normal.	Extremes.			Monthly range.	Daily ranges.			Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.										
					Highest barometer.	Date.	Lowest barometer.			Date.	Monthly range of barometer.	Max.		Date.	Mean max.	Min.							Date.	Mean min.	Greatest.	Date.	Least.	Date.	Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.
New England.																																	
Eastport	61	29.81	-.13	29.92	30.40	16	29.14	71.25	38.7	58.7	1	45.4	21.4	27	32.1	37.3	25.3	7	3.8	13	77.2	31.3	5.31	+1.61	6.171	sw.	44	sw.	7	13	10	7	
Portland	99	29.81	-.13	29.92	30.40	16	29.14	71.25	38.7	58.7	1	45.4	21.4	27	32.1	37.3	25.3	7	3.8	13	77.2	31.3	5.31	+1.61	6.171	sw.	44	sw.	7	13	10	7	
Mount Washington	6,279	23.48	-.13	29.92	30.40	16	29.14	71.25	38.7	58.7	1	45.4	21.4	27	32.1	37.3	25.3	7	3.8	13	77.2	31.3	5.31	+1.61	6.171	sw.	44	sw.	7	13	10	7	
Boston	125	29.81	-.13	29.92	30.40	16	29.14	71.25	38.7	58.7	1	45.4	21.4	27	32.1	37.3	25.3	7	3.8	13	77.2	31.3	5.31	+1.61	6.171	sw.	44	sw.	7	13	10	7	
Black Island	27	29.96	-.13	29.98	30.45	4	29.38	13.10	44.2	65.0	18	50.9	24.0	28	35.5	42.1	29.2	18	5.0	25	71.4	33.4	3.39	+1.51	8.584	sw.	52	sw.	18	12	8	15	7
Narragansett Pier	107	29.87	-.14	29.95	30.44	16	29.40	13.10	44.2	65.0	18	50.9	24.0	28	35.5	42.1	29.2	18	5.0	25	71.4	33.4	3.39	+1.51	8.584	sw.	52	sw.	18	12	8	15	7
New Haven	47	29.92	-.14	29.95	30.44	16	29.40	13.10	44.4	65.0	18	50.9	24.0	28	35.5	42.1	29.2	18	5.0	25	71.4	33.4	3.39	+1.51	8.584	sw.	52	sw.	18	12	8	15	7
New London	13	29.98	-.14	29.95	30.44	16	29.40	13.10	44.4	65.0	18	50.9	24.0	28	35.5	42.1	29.2	18	5.0	25	71.4	33.4	3.39	+1.51	8.584	sw.	52	sw.	18	12	8	15	7
Nantucket	13	29.98	-.14	29.95	30.44	16	29.40	13.10	44.4	65.0	18	50.9	24.0	28	35.5	42.1	29.2	18	5.0	25	71.4	33.4	3.39	+1.51	8.584	sw.	52	sw.	18	12	8	15	7
Edgartown	49.9	29.98	-.14	29.95	30.44	16	29.40	13.10	44.4	65.0	18	50.9	24.0	28	35.5	42.1	29.2	18	5.0	25	71.4	33.4	3.39	+1.51	8.584	sw.	52	sw.	18	12	8	15	7
Mt. Atlantic States.																																	
Albany	85	29.92	-.12	29.99	30.47	16	29.33	23.14	39.7	69.5	3	48.9	18.8	28	32.2	50.7	27.1	23	6.0	25	71.8	30.8	5.40	+2.72	5.279	sw.	32	sw.	18	14	11	15	4
New York City	168	29.84	-.11	30.01	30.43	16	29.48	23.05	45.3	72.7	2	54.8	28.6	8	38.8	44.1	23.4	18	5.6	25	68.9	35.1	4.61	+1.15	7.046	sw.	40	sw.	18	9	8	10	12
Philadelphia	117	29.81	-.10	30.03	30.47	16	29.50	23.06	46.5	72.7	2	54.9	28.6	8	38.8	44.1	23.4	18	5.6	25	68.9	35.1	4.61	+1.15	7.046	sw.	40	sw.	18	9	8	10	12
Atlantic City	13	30.01	-.11	30.03	30.44	16	29.48	23.05	45.3	72.7	2	54.8	28.6	8	38.8	44.1	23.4	18	5.6	25	68.9	35.1	4.61	+1.15	7.046	sw.	40	sw.	18	9	8	10	12
Sandy Hook	28	29.99	-.10	30.01	30.45	16	29.46	13.10	46.5	72.7	2	54.9	28.6	8	38.8	44.1	23.4	18	5.6	25	68.9	35.1	4.61	+1.15	7.046	sw.	40	sw.	18	9	8	10	12
Cape Henlopen	45	30.00	-.11	30.03	30.46	16	29.49	12.07	46.4	73.2	2	55.6	30.0	27	38.4	47.2	27.9	6	6.8	30	61.9	32.7	4.09	+0.98	4.708	sw.	28	sw.	25	10	8	12	10
Baltimore	106	29.95	-.10	30.05	30.47	16	29.50	18.07	46.1	73.1	2	55.8	30.0	27	38.4	47.2	27.9	6	6.8	30	61.9	32.7	4.09	+0.98	4.708	sw.	28	sw.	25	10	8	12	10
Ocean City	16	30.00	-.10	30.05	30.47	16	29.50	18.07	46.1	73.1	2	55.8	30.0	27	38.4	47.2	27.9	6	6.8	30	61.9	32.7	4.09	+0.98	4.708	sw.	28	sw.	25	10	8	12	10
Washington City	16	30.00	-.10	30.05	30.47	16	29.50	18.07	46.1	73.1	2	55.8	30.0	27	38.4	47.2	27.9	6	6.8	30	61.9	32.7	4.09	+0.98	4.708	sw.	28	sw.	25	10	8	12	10
Cape Henry	16	30.00	-.10	30.05	30.47	16	29.50	18.07	46.1	73.1	2	55.8	30.0	27	38.4	47.2	27.9	6	6.8	30	61.9	32.7	4.09	+0.98	4.708	sw.	28	sw.	25	10	8	12	10
Lynchburg	652	29.98	-.07	30.06	30.47	16	29.61	18.07	45.9	73.3	3	57.6	30.0	27	38.4	47.2	27.9	6	6.8	30	61.9	32.7	4.09	+0.98	4.708	sw.	28	sw.	25	10	8	12	10
Norfolk	30	30.06	-.06	30.07	30.42	16	29.49	25.03	51.2	74.5	25	61.1	29.7	14	43.6	45.1	33.0	25	7.8	22	68.2	39.8	1.94	+1.52	5.323	sw.	34	sw.	18	9	6	14	10
South Atlantic States.																																	
Charlotte	808	29.26	-.04	30.09	30.40	16	29.66	25.07	50.5	74.0	1	61.9	27.5	14	39.1	46.5	35.7	1	9.2	22	72.2	40.7	2.88	+1.18	2.814	sw.	35	sw.	18	11	7	12	11
Fort Macon	11	30.12	-.00	30.10	30.35	26	29.70	25.05	55.2	75.9	18	62.2	31.0	14	43.0	47.9	30.5	13	6.3	30	72.3	45.8	1.17	+1.79	8.599	sw.	46	sw.	6	4	2	13	15
Hatteras	12	30.15	-.01	30.10	30.38	16	29.70	25.05	55.2	75.9	18	62.2	31.0	14	43.0	47.9	30.5	13	6.3	30	72.3	45.8	1.17	+1.79	8.599	sw.	46	sw.	6	4	2	13	15
Kitty Hawk	9	30.10	-.05	30.09	30.41	16	29.61	25.08	54.0	75.1	4	63.1	30.1	27	45.9	46.0	30.2	13	6.3	4	70.8	43.9	1.39	+3.81	9.884	sw.	44	sw.	7	8	5	12	13
New River Inlet	34	30.00	-.07	30.07	30.42	16	29.49	25.03	51.2	74.5	25	61.1	29.7	14	43.6	45.1	33.0	25	7.8	22	68.2	39.8	1.94	+1.52	5.323	sw.	34	sw.	18	9	6	14	10
Smithville	34	30.00	-.07	30.07	30.42	16	29.49	25.03	51.2	74.5	25	61.1	29.7	14	43.6	45.1	33.0	25	7.8	22	68.2	39.8	1.94	+1.52	5.323	sw.	34	sw.	18	9	6	14	10
Wash Woods	52	30.08	-.04	30.10	30.36	26	29.75	30.01	55.3	77.4	2	67.7	29.7	14	43.5	47.7	33.6	25	7.8	22	68.2	39.8	1.94	+1.52	5.323	sw.	34	sw.	18	9	6	14	10
Wilmington	52	30.10	-.01	30.12	30.36	26	29.75	30.01	55.3	77.4	2	67.7	29.7	14	43.5	47.7	33.6	25	7.8	22	68.2	39.8	1.94	+1.52	5.323	sw.	34	sw.	18	9	6	14	10
Charleston	183	29.97	-.02	30.14	30.40	14	29.72	25.05	51.9	75.9	18	62.2	31.0	14	43.0	47.9	30.5	13	6.3	30	72.3	45.8	1.17	+1.79	8.599	sw.	46	sw.	6	4	2	13	15
Augusta	87	30.08	-.01	30.14	30.36	26	29.75	30.01	55.3	77.4	2	67.7	29.7	14	43.5	47.7	33.6	25	7.8	22	68.2	39.8	1.94	+1.52	5.323	sw.	34	sw.	18	9	6	14	10
Savannah	43	30.13	-.04	30.14	30.36	26	29.88	25.04	59.1	75.9	18	62.2	31.0	14	43.0	47.9	30.5	13	6.3	30	72.3	45.8	1.17	+1.79	8.599	sw.	46	sw.	6	4	2	13	15
Jacksonville	30	30.18	-.08	30.16	30.39	19	29.91	25.04	60.0	76.2	1	71.9	37.0	26	51.9	43.7	29.7	18	8.2	24	72.5	50.3	0.58	+2.03	5.496	sw.	34	sw.	18	9	6	14	10
Florida Peninsula.																																	
Cedar Keys	30	30.18	-.08	30.16	30.39	19	29.91	25.04	60.0	76.2	1	71.9	37.0	26	51.9	43.7	29.7	18	8.2	24	72.5	50.3	0.58	+2.03	5.496	sw.	34	sw.	18	9	6	14	10
Key West	30	30.11	-.07	30.08	30.31	18	29.95	24.06	73.2	73.2	1	71.9	37.0	26	51.9	43.7	29.7	18	8.2	24	72.5	50.3	0.58	+2.03	5.496	sw.	34	sw.	18	9	6	14	10
Sanford	25	30.12	-.07	30.11	30.33	19	29.92	24.06	73.2	73.2	1	71.9	37.0	26	51.9	43.7	29.7	18	8.2	24	72.5	50.3	0.58	+2.03	5.496	sw.	34	sw.	18	9	6	14	10
Eastern Gulf States.																																	
Atlanta	1,129	28.96	-.02	30.13	30.41	26	29.71	17.07	50.6	75.2	1	60.2	27.9	7	41.1	47.3	3																

Table of miscellaneous meteorological data for November, 1886—Signal Service observations—Continued.

Stations.	Elevation above sea level.	Atmospheric pressure (in inches and hundredths).					Temperature of the air (in degrees Fahrenheit).												Winds.																
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.			Monthly range of barometer.	Monthly mean.	Departure from normal.	Extremes.			Monthly range.	Daily ranges.			Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.		No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.						
					Highest barometer.	Lowest barometer.	Date.				Max.	Date.	Mean max.		Min.	Date.	Mean min.							Greatest.	Least.					Date.	Miles p. h.	Direction.			
Upper Miss. Valley.																																			
Saint Paul.	831	29.06	-.06	29.99	30.48	15	29.17	23	1.31	27.9	-3.2	73.6	1	36.8	-3.3	29	19.4	76.9	35.3	8	6.5	25	69.3	17.9	2.07	+.075	6,105	w.	35	w.	5	11	8	17	8
La Crosse.	725	29.22	-.03	30.02	30.50	15	29.23	17	1.27	33.1	-0.7	73.8	1	41.4	0.7	30	26.6	61.1	29.6	23	4.0	16	73.2	25.2	1.32	-.057	5,994	w.	36	w.	2	8	5	14	8
Davenport.	615	29.10	-.08	30.01	30.47	15	29.28	17	1.19	35.8	-1.7	68.5	1	45.4	9.6	25	27.7	58.9	30.0	4	6.8	9	73.0	27.4	1.86	-.049	5,064	n.	26	w.	22	9	8	13	9
Des Moines.	849	29.10	-.08	30.01	30.45	15	29.25	17	1.19	33.2	-2.3	69.5	1	42.1	11.3	20	31.4	54.2	28.7	3	8.4	12	71.0	29.2	1.15	-.086	7,369	n.	26	w.	22	9	8	13	9
Dubuque.	665	29.28	-.06	30.03	30.45	15	29.10	22	1.04	38.5	-0.2	69.4	1	47.6	15.2	25	37.1	49.6	32.5	1	4.4	30	65.3	32.6	5.73	+.179	6,341	n.	32	sw.	2	9	7	13	10
Keokuk.	618	29.36	-.06	30.08	30.51	27	29.55	23	0.94	45.3	-0.9	74.2	22	53.8	24.6	25	33.9	52.6	29.6	23	9.0	25	66.2	31.4	1.74	-.147	7,344	w.	34	w.	17	13	9	13	10
Cairo.	359	29.71	-.07	30.03	30.46	20	29.49	22	0.97	42.4	0.0	72.9	2	52.3	20.3	26	37.8	51.9	29.0	23	6.8	11	61.4	31.8	3.30	+.073	8,772	w.	43	sw.	18	13	11	6	11
Springfield.	544	29.36	-.08	30.05	30.46	20	29.49	22	0.97	42.4	0.0	72.9	2	52.3	20.3	26	37.8	51.9	29.0	23	6.8	11	61.4	31.8	3.30	+.073	8,772	w.	43	sw.	18	13	11	6	11
Saint Louis.	571	29.44	-.09	30.04	30.47	26	29.51	22	0.97	45.6	+.25	75.1	1	54.5	23.5	25																			
Missouri Valley.																																			
Lamar.	1,028	29.16	-.07	30.05	30.49	26	29.44	22	1.05	44.0	+.38	77.0	1	51.6	15.0	25	30.9	62.0	32.2	19	7.5	16	65.1	28.4	1.10	-.134	5,817	n.	27	sw.	4	5	4	14	12
Leavenworth.	842	29.16	-.07	30.05	30.49	26	29.44	22	1.05	44.0	+.38	77.0	1	51.6	15.0	25	30.9	62.0	32.2	19	7.5	16	65.1	28.4	1.10	-.134	5,817	n.	27	sw.	4	5	4	14	12
Omaha.	1,113	28.80	-.07	30.05	30.50	26	29.42	22	1.08	34.2	-1.9	73.1	1	45.5	9.1	25	25.9	64.0	30.4	22	9.0	15	67.4	28.0	1.54	+.022	7,210	n.	37	sw.	17	6	7	12	11
Valentine.	2,604	27.30	-.02	30.08	30.51	14	29.38	22	1.14	29.9	-.59	40.2	4	40.2	3.0	18	20.1	62.0	36.5	18	6.7	1	70.5	20.5	0.56	+.022	7,210	n.	37	sw.	17	6	7	12	11
Huron.	1,307	28.61	-.02	30.06	30.54	14	29.38	22	1.49	27.0	-3.3	60.2	8	38.9	-5.0	30	16.3	65.2	41.2	13	5.2	1	64.4	15.3	1.18	+.062	7,025	n.	42	sw.	22	9	8	12	10
Yankton.	1,234	28.68	-.08	30.03	30.49	11	29.21	22	1.28	30.7	-1.0	70.4	1	41.0	0.0	25	20.7	70.4	37.2	13	3.5	17	69.7	21.1	2.44	+.191	7,155	n.	37	n.	17	9	6	13	11
Northern slope.																																			
Fort Assinaboine.	2,720	27.21	+.06	30.12	30.79	15	29.64	3	1.14	29.7	-0.8	61.2	7	40.9	-26.8	23	15.3	88.0	53.6	23	8.7	28	59.6	16.9	0.74	-.021	10,310	sw.	49	sw.	27	4	5	16	9
Fort Benton.	2,661	27.21	+.06	30.12	30.79	15	29.64	3	1.14	29.7	-0.8	61.2	7	40.9	-26.8	23	15.3	88.0	53.6	23	8.7	28	59.6	16.9	0.74	-.021	10,310	sw.	49	sw.	27	4	5	16	9
Fort Custer.	3,040	26.89	+.04	30.13	30.66	16	29.65	29	1.02	31.0	-1.6	62.0	2	43.0	-10.2	23	20.1	72.2	39.4	6	4.7	22	73.9	22.2	0.36	-.010	5,319	sw.	41	sw.	2	8	8	12	9
Fort Maginnis.	4,340	25.55	+.03	30.05	30.65	15	29.60	8	1.05	30.0	-4.9	63.0	7	41.9	-14.0	22	21.8	77.0	43.9	17	10.5	8	65.7	18.9	1.67	+.105	11,530	n.	52	sw.	27	11	8	15	7
Fort Shaw.	3,550	25.89	+.03	30.15	30.70	15	29.59	20	1.11	29.4	-1.8	58.8	3	38.5	-8.8	22	20.2	67.6	38.6	23	9.0	1	68.9	20.1	0.49	-.010	5,273	sw.	44	sw.	27	8	9	13	8
Helena.	4,069	25.89	+.03	30.15	30.70	15	29.59	20	1.11	29.4	-1.8	58.8	3	38.5	-8.8	22	20.2	67.6	38.6	23	9.0	1	68.9	20.1	0.49	-.010	5,273	sw.	44	sw.	27	8	9	13	8
Poplar River.	2,030	27.89	+.03	30.09	30.66	15	29.55	3	1.11	23.3	-3.1	59.6	7	38.4	-19.1	23	10.1	78.1	46.7	12	9.7	29	69.6	13.0	0.69	+.037	5,615	w.	40	n.	4	7	6	13	11
Deadwood.	4,600	25.35	+.03	30.14	30.58	16	29.60	22	0.98	29.3	-3.9	53.2	8	37.8	-4.8	17	21.4	58.0	34.6	18	4.0	24	73.7	21.7	3.24	+.213	3,822	sw.	14	sw.	21	13	6	12	12
Cheyenne.	6,105	27.09	-.03	30.10	30.57	5	29.37	22	1.20	31.9	-2.9	66.7	1	42.6	-5.0	18	22.2	71.7	35.0	18	9.7	30	76.7	24.7	0.43	-.001	6,907	w.	40	n.	16	4	2	12	16
North Platte.	2,841	27.09	-.03	30.10	30.57	5	29.37	22	1.20	31.9	-2.9	66.7	1	42.6	-5.0	18	22.2	71.7	35.0	18	9.7	30	76.7	24.7	0.43	-.001	6,907	w.	40	n.	16	4	2	12	16
Fort Laramie.																																			
Middle slope.																																			
Denver.	5,294	24.72	-.03	30.07	30.51	26	29.45	21	1.06	33.2	-4.7	63.0	4	45.5	-6.0	17	20.4	69.0	39.8	12	16.2	9	61.3	19.1	1.93	+.124	6,683	n.	38	w.	30	6	4	11	15
Pike's Peak.	14,134	17.00	+.03	30.13	30.66	26	29.45	21	1.06	33.2	-4.7	63.0	4	45.5	-6.0	17	20.4	69.0	39.8	12	16.2	9	61.3	19.1	1.93	+.124	6,683	n.	38	w.	30	6	4	11	15
Las Animas.	3,899	26.06	+.03	30.09	30.56	26	29.42	22	1.14	32.3	-5.9	75.2	4	51.7	-6.0	17	17.2	51.2	51.9	4	12.2	15	74.7	23.6	0.23	-.008	4,956	n.	42	w.	1	3	2	7	21
Concordia.	1,384	28.57	+.03	30.05	30.53	26	29.42	22	1.12	37.3	-7.2	1.2	49.7	2.5	17	25.7	68.7	38.2	7	9.3	11	59.5	23.7	1.29	-.008	6,640	n.	36	n.	17	5	5	14	14	
Dodge City.	2,523	27.43	-.02	30.11	30.60	26	29.50	22	1.10	38.1	-1.2	73.0	1	54.2	7.3	12	24.2	65.7	44.1	25	15.3	19	65.3	25.7	0.24	-.039	6,062	n.	44	sw.	16	3	3	7	20
Fort Reno.	2,523	27.43	-.02	30.11	30.60	26	29.50	22	1.10	38.1	-1.2	73.0	1	54.2	7.3	12	24.2	65.7	44.1	25	15.3	19	65.3	25.7	0.24	-.039	6,062	n.	44	sw.	16	3	3	7	20
Fort Supply.	2,650	27.29	-.08	30.02	30.48	26	29.51	21	0.97	42.8	+.07	73.5	1	60.6	10.3	17	31.3	63.2	42.3	19	10.6	11	62.5	29.2	0.18	-.047	7,762	n.	50	sw.	16	2	1	11	18
Fort Elliott.	2,650	27.29	-.08	30.02	30.48	26	29.51	21	0.97	42.8	+.07	73.5	1	60.6	10.3	17	31.3	63.2	42.3	19	10.6	11	62.5	29.2	0.18	-.047	7,762	n.	50	sw.	16	2	1	11	18
Southern slope.																																			
Fort Bill.	1,200	28.86	-.03	30.11	30.62	26	29.57	22	1.05	48.2	+.03	76.9																							

Girard, Crawford county, Kansas: a tornado occurred at 8.40 a. m. of the 22d, destroying all the lighter buildings in its track, and injuring a number of persons. The path of the storm was only from fifty to seventy-five feet in width. Outside of Girard the damage was slight.

Mount Sterling, Montgomery county, Kentucky: a tornado, one hundred yards wide, passed through Bath county on the morning of the 26th, uprooting large trees, blowing down fences, and destroying light houses.

NAVIGATION.

STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for November, 1886, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, November, 1886.

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	30	10.4	14, 15	6.4	4.0
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	25	9.4	15, 16, 18 to 21, 30	1.1	1.3
Little Rock, Arkansas.....	23.0	25	8.0	3, 8	1.2	6.8
<i>Missouri River:</i>						
Yankton, Dakota.....	24.0	1, 2, 3	15.3	7	15.0	0.3
Omaha, Nebraska.....	18.0	1, 2, 3	6.2	26 to 29	4.9	1.3
Leavenworth, Kansas.....	20.0	20, 21	5.3	28	2.3	3.1
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14.5	22	2.8	14	2.4	0.4
La Crosse, Wisconsin.....	24.0	1 to 5	4.6	26, 27	2.5	2.1
Dubuque, Iowa.....	16.0	1	5.2	30	1.9	3.3
Kokuk, Iowa.....	14.0	1	4.0	30	0.6	3.4
Saint Louis, Missouri.....	32.0	12	7.6	30	4.1	3.5
Cairo, Illinois.....	40.0	30	23.9	11, 12	3.8	20.1
Memphis, Tennessee.....	34.0	30	16.0	15, 16	3.4	12.6
Vicksburg, Mississippi.....	41.0	30	8.5	16, 19	0.0	8.5
New Orleans, Louisiana.....	13.0	17	2.8	27	1.0	1.6
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	26	13.0	17	3.9	9.1
Cincinnati, Ohio.....	50.0	29	30.2	2	3.0	27.2
Louisville, Kentucky.....	25.0	25	11.6	1 to 4	2.6	9.0
<i>Cumberland River:</i>						
Nashville, Tennessee.....	40.0	27	22.6	1	0.5	22.1
<i>Tennessee River:</i>						
Chattanooga, Tennessee.....	33.0	28	13.7	5 to 8, 11 to 14	1.4	12.3
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29.0	26	13.0	17	3.9	9.1
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	27	11.5	7	5.4	6.1
<i>Mobile River:</i>						
Mobile, Alabama.....		17	18.5	15	15.5	3.0
<i>Sacramento River:</i>						
Sacramento, California.....		2 to 11, 23	8.0	1, 12 to 22	7.8	0.2
<i>Willamette River:</i>						
Portland, Oregon.....		[to 30]	2.0	6	—1.1	3.1
<i>Colorado River:</i>						
Yuma, Arizona.....		3, 11, 25	15.4	1, 27 to 30	15.2	0.2

Light ice passed down the Mississippi River at La Crosse, Wisconsin, from the 19th to 23d, from the 24th to 28th the flowing ice had become heavy, and on the 29th the river was frozen over and navigation closed. The "Mountain Belle," the last boat of the season at La Crosse, arrived and departed on the 21st. The steamer "Saint Paul" left Saint Paul, Minnesota, for Saint Louis, Missouri, on the 10th; this was the last departure of the season and, owing to the heavy ice in the river, navigation was practically closed on that date.

On the Red River of the North at Saint Vincent, Minnesota, the cold weather preceding the 24th had thickened the ice to such an extent as to cause a suspension of navigation and the ferry boat plying between this point and Pembina, Dakota, was obliged to lay up, thus closing navigation here for the season of 1886. By the 30th the ice on the river had become strong enough to allow heavily-loaded teams to cross.

The Tennessee River below Chattanooga became navigable about the 20th, after having been closed since the middle of July, when all boating was practically stopped by low water.

The following notes relate to the state of river navigation during the month:

Cairo, Illinois: the rise in the Ohio River which commenced on the 17th enabled all river craft to resume navigation about

the 24th. The Mississippi River between here and Saint Louis remains comparatively low.

Nashville, Tennessee: navigation was resumed on the Cumberland River on the 18th; the river had been unnavigable on account of low water since July 30th.

Louisville, Kentucky: navigation on the Ohio River was resumed at this point on the 19th, for several weeks prior to this date navigation had been discontinued by the larger class of boats.

Little Rock, Arkansas: on the 19th the Arkansas River began rising rapidly and several boats left port on that date; the river had been very low since October 11th.

Green Bay, Wisconsin: on the 24th Green Bay became frozen over and navigation at this port was closed for the winter.

Bismarck, Dakota: the Missouri River froze over at this point during the 16th and 17th and navigation was closed for the season.

Duluth, Wisconsin: navigation at this port closed for the season on the 30th; last departure for the lower lakes on the 28th; last arrival, the propeller "James Fisk, jr.," on the 30th.

FLOODS.

Buffalo, New York: during the heavy storm that prevailed during the 18th and 19th the wind blew steadily from the west, driving the water of the lake over the lower portion of city and damaging considerable property. Over two hundred feet of the track of the New York Central Railroad were undermined and washed away; the damage done was estimated at \$10,000. The sea-wall was damaged, and all houses along a canal which runs through a part of the city were filled with water to a depth of two feet. Considerable farm property along the lake shore was submerged.

Poughkeepsie, Dutchess county, New York: on the morning of the 18th over two inches of rain fell in three hours; this is the largest rainfall that has occurred within such a short time for several years. Streams were suddenly swollen and sewers choked, while the lower part of the town was flooded. The storm was accompanied by high southeasterly winds, blowing down telegraph poles and signs and interrupting communication.

Memphis, Tennessee: on the 24th a freshet in Wolfe River, the result of heavy rains during the previous week, carried away lumber and damaged other property to an extent of \$6,000.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Mount Washington, New Hampshire: an auroral light was noticed in the north at 7.50 p. m. of the 2d; when first seen it was in the form of a white light with a slight, lateral, wavy motion from west to east. The aurora at its centre rested directly on the northern horizon and extended about 30° east and west of the north; altitude 50°. At 9.20 p. m. a few streamers were observed rising from the centre of the aurora and terminating near the zenith; streamers were seen at intervals of from three seconds to five minutes until 10.40 p. m. The display reached its maximum brilliancy between 9.20 and 10.40 p. m. and disappeared after midnight.

Fort Assinaboine, Montana: an auroral arch was visible from 11.33 to 11.57 p. m. of the 2d; it was of a pale straw color; altitude, 7°; azimuth, 50°; no streamers appeared. The display was obscured by clouds at 11.57 p. m. On the 3d a brilliant aurora was visible from 10.35 to 11.20 p. m. The observer states that in shape and color it resembled that seen on the previous night, and appeared to be a continuation of the same aurora, although the display of the 3d was accompanied by streamers of a bluish white tint extending almost to the zenith and having a motion resembling the blaze of a large fire when disturbed by the wind.

Duluth, Minnesota: on the 3d, at 10.15 p. m., a faint aurora in the form of a broad belt of light was visible in the northern horizon; azimuth, 160° to 240°; altitude, 10°; the display ended at 11.55 p. m.

Port Huron, Michigan: on the 4th, at 10.30 p. m., a brilliant aurora was observed with numerous beams flashing up toward the zenith; at 12.15 a. m. the aurora had assumed the shape of two arches, the lower one extending from azimuth 95° to 260°. The display was brightest at 1.10 a. m. of the 5th, after which it gradually faded, but was still visible at 1.45 a. m.

Buffalo, New York: an aurora was visible from 9.20 to 11.15 p. m. of the 23d; it consisted of a diffused white light resting on a broad arch of slate-colored sky. It varied but little in brilliancy and began to fade at 10.30 p. m.

Fort Totten, Dakota: on the 23d an aurora was visible from 9.40 p. m. until midnight; it consisted of a double arch, with beams of light shooting upward from the lower one until 11 p. m.

Auroral displays were also observed during the month, as follows:

2d.—Voluntown, Connecticut; Webster, Dakota; Eastport, Kent's Hill, and Orono, Maine; Amherst, Westborough, and Cambridge, Massachusetts; Nashua, New Hampshire; North Volney, New York; Embarras, Wisconsin.

3d.—Webster, Dakota; Monticello, Iowa; Escanaba, Michigan; Moorhead, Minnesota; Poplar River, Montana; Green Bay, Wisconsin.

4th.—Monticello, Iowa; Vineyard Haven and Amherst, Massachusetts; Escanaba, Michigan; Poplar River, Montana; Nashua, New Hampshire.

5th.—Mackinaw City, Michigan; Poplar River, Montana.

6th.—Fort Buford, Dakota; Pekin, Illinois.

7th.—Ithaca, New York.

14th.—Pekin, Illinois.

15th.—Mackinaw City, Michigan.

18th.—Amherst, Massachusetts.

20th.—Portland, Maine; Milton and North Truro, Massachusetts.

21st.—Yankton, Dakota.

22d.—Cresco, Iowa; Poplar River, Montana.

23d.—Webster, Dakota; Cedar Rapids, Iowa; Escanaba, Michigan; Poplar River, Montana; Prairie du Chien, Wisconsin.

24th.—Escanaba, Michigan.

25th.—Kent's Hill, Maine; Mackinaw City, Michigan.

27th.—Pekin, Illinois.

29th.—Escanaba and Mackinaw City, Michigan; North Truro, Massachusetts; Nashua, New Hampshire.

30th.—Fort Buford, Dakota; Escanaba and Mackinaw City, Michigan; Moorhead, Minnesota.

ELECTROMETER READINGS.

[Prepared under the direction of Prof. T. C. MENDENHALL, Assistant.]

Observations have been made during the month of November, 1886, daily, at 9 a. m., 11 a. m., 1 p. m., and 3 p. m., at five stations, and continuously by means of photography at one station.

At Washington City the observations, compared with those of the preceding month, show a higher general average. At four different times were negative indications obtained. The dates and accompanying conditions of these indications were as follows:

November 6th, in the afternoon, highest value about 100 volts, during light rain; November 12th, from 11.20 a. m. until 12.25 p. m., and from 1.51 p. m., with intervals of positive, until late in the afternoon. The highest negative value, nearly 600 volts, when the weather was rainy. On November 25th, in the afternoon, the highest value, about 450 volts, during heavy rain. On November 30th, in the afternoon, during light rain.

Every instance of negative electricity, as far as the observations go, occurred during rain.

On November 3d and 12th observations were made simultaneously at the top of the Washington Monument and at the Instrument Room of the Signal Office. The observations when plotted give the curves shown in the two diagrams of chart number vi. These experiments are of particular interest for

several reasons. They may be taken as fairly illustrative of the difference in the value of the potential at two different heights, and the effect of the weather in modifying these values. The two days were, as regards weather, exactly opposite. November 3d was a bright, fair day, a trifle hazy, with very light wind and a haze or smoke on the northern and northwestern horizon. The sky was about 0.7 covered with cirro-stratus clouds with hardly any motion. November 12th began with a cloudy, threatening morning, with fresh northeasterly winds, and a prediction, based upon the indications of the electrometer, of coming rain. Rain did not fall at the Monument until 11.30 a. m., although the electrometer gave a zero value at 11.12, and from that time on a steadily increasing negative value, until just preceding the rain, when the indications, although all negative, were very variable. Rain is recorded at the Signal Office as beginning at 11.20 a. m., the electrometer there indicating a positive value at 11.15 and a negative value at 11.20 a. m. At the Monument thick sparks could be obtained, at least as many as thirty per minute. During the afternoon masses of fog would drift by, sometimes below and sometimes enveloping the top of the Monument.

The following abridged record of the observations at the two places shows many interesting features:

Time.	November 3.			November 12.		
	Monument.	Signal Office.	Difference.	Monument.	Signal Office.	Difference.
	Volts.	Volts.	Volts.	Volts.	Volts.	Volts.
10.45 a. m.	1250			500	90	410
11 a. m.	1225	282	943	575	132	443
11.05 a. m.	1175	306	869	450	84	366
11.10 a. m.	1200	288	912	125	114	11
11.15 a. m.	1350	258	1092	— 50	24	74
11.20 a. m.	1325	258	1067	— 200	— 6	196
11.25 a. m.	1400	324	1076	— 600	— 102	498
11.30 a. m.	1400	324	1076	— 575	— 90	485
11.35 a. m.	1100	354	746	— 1300	— 288	1012
11.40 a. m.	1125	252	873	— 1650	— 594	1056
11.45 a. m.	1200	264	936	— 500	— 468	
11.50 a. m.	1200	258	942	— 250	— 480	
11.55 a. m.	1150	258	892	— 1250	— 480	1120
12 m.	1200	258	942	— 1500	— 378	
12.05 p. m.	1325	240	1085	— 1500	— 246	1254
12.10 p. m.	1300	246	1054	— 750	— 476	474
12.15 p. m.	1225	240	985	— 700	— 186	514
12.20 p. m.	1325	222	1091	— 375	— 42	233
12.25 p. m.	1325	294	1031	100	— 42	58
12.30 p. m.	1225	300	925	600	30	570
12.35 p. m.	1225	300	925	625	60	565
12.40 p. m.	1125	300	825	250	30	220
12.45 p. m.	1200	270	930	225	24	201
12.50 p. m.	1150	262	888	75	18	57
12.55 p. m.	1075	240	835	350	36	314
1 p. m.	1200	246	954	125	6	119
1.01 p. m.	1175	246	829	125	6	119
1.02 p. m.	1150	234	916	75	0	75
1.03 p. m.	1138	240	898	100	0	100
1.04 p. m.	1125	246	879	125	6	246
1.05 p. m.	1150	240	910	300	18	407
1.06 p. m.	1138	246	892	425	24	476
1.07 p. m.	1125	192	933	450	24	426
1.08 p. m.	1125	228	897	300	24	376
1.09 p. m.	1162	294	868	250	18	332
1.10 p. m.	1162	270	892	200	12	188
1.11 p. m.	1150	286	864	250	12	238
1.12 p. m.	1138	276	862	300	18	282
1.13 p. m.	1175	270	905	400	24	376
1.14 p. m.	1175	273	902	500	30	470
1.15 p. m.	1150	282	868	600	30	570
1.16 p. m.	1125	279	846	500	30	470
1.17 p. m.	1075	294	781	450	18	432
1.18 p. m.	950	270	680	400	24	376
1.19 p. m.	925	270	655	375	24	351
1.20 p. m.	912	258	654	375	18	357
1.21 p. m.	925	252	673	375	18	357
1.22 p. m.	950	246	704	375	24	351
1.23 p. m.	1000	240	760	400	30	370
1.24 p. m.	1025	228	797	450	36	414
1.25 p. m.	1050	216	834	525	36	489
1.26 p. m.	1025	222	803	825	42	783
1.27 p. m.	1012	228	784	1050	48	1002
1.28 p. m.	975	246	729	1100	66	1034
1.29 p. m.	925	234	691	1350	78	1472

Electrometer Readings—Continued.

Time.	November 3.			November 12.		
	Monument.	Signal Office.	Difference.	Monument.	Signal Office.	Difference.
1.30 p. m.	Volts. 900	Folts. 216	Folts. 684	Volts. 1350	Folts. 84	Folts. 1266
1.34 p. m.	888	246	642	1750	72	1678
1.34 p. m.	900	216	684	450	30	420
1.36 p. m.	872	246	616	325	18	207
1.38 p. m.	875	240	635	— 50	12	62
1.40 p. m.	825	222	603	— 50	6	56
1.42 p. m.	862	270	592	— 50	0	50
1.44 p. m.	900	180	720	300	18	282
1.46 p. m.	888	216	672	875	42	833
1.48 p. m.	900	240	660	—	48	—
1.50 p. m.	912	304	708	0	18	18
1.52 p. m.	862	210	652	— 250	— 12	238
1.54 p. m.	850	228	622	— 150	— 6	146
2 p. m.	875	210	665	1000	30	970
2.02 p. m.	775	210	565	1250	12	1238
2.10 p. m.	850	234	616	— 500	— 30	470
2.15 p. m.	825	204	621	— 750	— 54	266
2.20 p. m.	800	210	590	825	—	819
2.25 p. m.	800	246	554	1500	0	1500
2.30 p. m.	750	240	510	875	42	832
2.35 p. m.	750	288	462	— 375	— 30	545
2.40 p. m.	750	288	462	— 750	— 48	702
2.45 p. m.	—	252	—	1000	6	994
2.50 p. m.	700	300	400	— 100	— 54	46
2.55 p. m.	700	228	572	— 200	— 42	158

The total difference between the values at the two stations for 79 observations, on November 3d, the bright, fair day, is 62,992 volts, or for a difference in altitude of 455 feet, an average difference in the value of the potential equivalent to 797 volts, or nearly 800 volts. For November 12th the sum of the differences in value of the potential at the two stations for 77 observations is 37,231 volts, or an average difference of 483 volts—for the same difference of 455 feet. It may be interesting to compare these values with those given by observations at other times. In the MONTHLY WEATHER REVIEW for October, 1886, are given the values obtained on different dates. The means of those observations are for October 4th, from 48 observations, 398 volts; on October 5th, from 38 observations, 210 volts; on October 7th, from 40 observations, 333 volts.

It will be noticed that the curves for the lower station seem to lag a little, compared with the curves for the upper, regarding any sudden fluctuation in either direction. It is proper to mention that all care was taken to have the observations made synchronously. Of the regular observations, the highest positive values occurred on November 20th, all four observations averaging over 500 volts, the weather being clear with slight haze and light southerly winds. The next highest value occurred on November 5th, at 11 a. m., being almost 500 volts. The highest negative values occur on November 12th, at 11.40 a. m., during heavy rain, and on November 25th, at 3 p. m., during heavy rain.

At Baltimore, Maryland, a continuous record for the month has been obtained. The following is from the observer's report: "The month has been one of rather more than usual electrical disturbance; variations are shown on many sheets, preceding and accompanying rain." There is a very close correspondence in the character of the curves at Washington and those at Baltimore, on November 12th, during the rain previously referred to; the Washington curve, however, seems to lag about 45 minutes behind the curve for Baltimore.

At New Haven, Connecticut, negative indications are recorded on five dates, as follows: November 6th, during rain; November 10th, during light rain; November 12th, during rain, preceded by low positive; on November 17th, at 9 a. m., during light rain, the remaining observations being positive, although the rain continued; November 23d, the highest negative value, 116 volts, in the morning, the observations for the rest of the day being positive, although the rain continued, turning in the afternoon to fog. On November 25th light rain

was accompanied by low positive. On November 25th light rain was accompanied by low positive. On November 18th light rain was accompanied by positive values as low as 0.2 volt. The highest positive values occur on November 2d and November 5th, 77 volts, and on November 27th, 66 volts, during clear weather. On November 12th, that being considered as a term day, we find at New Haven, at 9 a. m., a positive indication, in value 9 volts; at 11 a. m., 11.9 volts; at 1 p. m., 5.3 volts; at 3 p. m., 39.4. Rain began at 1.03 p. m., continuing all day, the next day, November 13th, being cloudy and threatening, the values for this date were 6.2 volts at 9 a. m., 1.3 volts at 11 a. m., 1 volt at 1 p. m., and 2.5 at 3 p. m.

At Boston, Massachusetts, a very complete and valuable set of observations has been made. Rain began November 6th at 11.50 a. m., accompanied with positive values. In this case the electrometer gave no indication of the approach or disturbing effect of rain. On November 10th rain began at 1.30 p. m. At 11 a. m. the values were negative, 75.8 volts; at 1 p. m., 59.2 volts, and at 3 p. m., during the rain, positive, 29.0 volts. On November 13th rain all day was accompanied by low positive values. On November 17th rain was accompanied by high positive values; November 18th threatening weather and rain, accompanied by very high positive values, averaging 345 volts, throughout the day. High positive values continued until the 23d, when rain all day was accompanied by low positive values. On November 25th rain in the morning was accompanied by low positive, and rain in the afternoon by high negative. After the rain very high positive values are recorded. A negative indication occurred on November 15th at 9 a. m., the weather being clear, and no apparent meteorological disturbance in connection with it. The highest positive values obtained during the month were on November 2d in the morning, and November 28–29th.

The observations on November 12th are as follows: At 9 a. m. positive, 129 volts, the weather cloudy; at 11 a. m. positive, 248, the weather fair; at 1 p. m., positive, 160, the weather cloudy; at 3 p. m., positive, 135, the weather cloudy. On November 13th, at 9 a. m., positive, 14 volts, light rain; at 11 a. m., positive, 19, during light rain; at 1 p. m., positive, 37.2, during light rain. Light snow fell during the night and the next morning, clear and bright, the values were about 118 volts, positive.

At Ithaca, New York, a very full and valuable set of observations has been made. Negative values occur on November 6th, during cloudy weather, at 9 a. m., changing to low positive at 11 a. m., and negative, changing to positive, during the afternoon. Light rain began at 12.30 p. m., changing to snow at 1 p. m. During this snow the readings varied, as follows: at 2.59 p. m., negative, 160 volts; at 3 p. m., negative, 121 volts; at 3.01 p. m., negative, 35 volts; at 3.02, positive, 50 volts; at 3.04 p. m., positive, 400 volts; at 3.06, positive, 755 volts; at 3.08 p. m., positive, 855 volts.

On November 11th, low positive at 1 p. m., changing to low negative, with light rain from 1.30 to 2.30 p. m. On November 12th, low positive at 9 a. m., with negative values at 11 a. m. Light snow began at 11.30 p. m.; negative values at 1 p. m., and positive values throughout the rest of the afternoon, during light snow, which continued throughout the next day. Very high positive potentials, about 1,800 volts, were obtained during this snow. On November 14th, after the heavy snowfall of the two days preceding, negative values were obtained during clear weather. On November 15th, at 3 p. m. negative values during clear weather. On November 17th, high negative values throughout the day during light rain. In addition to the date already mentioned snow fell on November 7th and 19th, with positive values. On November 16th the needle was observed to oscillate considerably.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories during the month, as follows:

Arizona.—Fort Grant, 4th; Fort Apache, 4th, 9th, 11th, 17th, 19th; Yuma, 11th; Prescott, 11th, 18th.

Arkansas.—Lead Hill, 7th.

California.—Fall Brook, 6th; Los Angeles, 11th, 18th; San Francisco, 16th, 17th, 19th.

Connecticut.—North Colebrook, 16th.

Dakota.—Fort Totten, 24th, 28th, 30th; Fort Meade, 25th; Fort Buford, 30th.

District of Columbia.—Washington City, 13th, 21st.

Florida.—Sanford, 10th, 19th; Archer, 19th.

Georgia.—Augusta, 20th.

Idaho.—Boisé City, 5th.

Illinois.—Riley, 1st, 16th, 19th, 20th, 26th, 29th; Chicago and Charleston, 16th.

Indiana.—Indianapolis, 5th, 16th; Laconia and Sunman, 16th; Logansport, 27th; Vevay, 28th.

Iowa.—Cresco, 6th, 19th; Monticello, 15th, 27th; Independence, 24th; Cedar Rapids, 24th, 26th.

Kansas.—Wyandotte, 1st, 4th, 5th, 7th, 9th; Yates Centre and Independence, 7th; Salina, 9th; Leavenworth, 19th; Manhattan, 28th.

Kentucky.—Frankfort, 20th.

Maine.—Cornish, 6th, 12th, 28th.

Massachusetts.—Blue Hill Observatory, 2d, 6th, 12th, 16th, 30th; North Truro, 3d, 12th, 13th, 20th, 30th; Amherst, 4th, 16th; Milton, 6th; Somerset, 6th, 12th, 16th, 28th, 30th.

Michigan.—Mottville, 1st, 5th, 16th; Lansing, 12th, 16th; Marquette, 16th; Alpena, 19th; Escanaba, 25th.

Minnesota.—Moorhead, 15th, 16th, 23d, 24th, 25th.

Missouri.—Saint Louis, 8th; Centreville, 10th, 22d.

Montana.—Poplar River, 3d, 14th, 30th.

Nebraska.—Brownville, 20th.

New Jersey.—Clayton, 15th.

New York.—Oswego, North Truro, and Palermo, 16th.

North Carolina.—New River Inlet, 2d, 5th, 12th, 17th, 21st, 24th.

Ohio.—Elyria, 2d; Wauseon, 2d, 3d, 6th, 15th, 26th.

Oregon.—East Portland, 3d, 4th; Albany, 16th; Roseburg, 16th, 26th.

South Carolina.—Stateburg, 3d; Spartanburg, 19th.

Tennessee.—Nashville, 5th, 20th, 27th.

Texas.—Abilene, 12th.

Virginia.—Dale Enterprise, 2d, 3d; Variety Mills, 2d, 3d, 11th.

Wisconsin.—Manitowoc, 15th; Delavan, 15th, 20th, 26th.

Wyoming.—Fort Bridger, 18th, 24th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories during the month, as follows:

Alabama.—Mobile, 2d, 5th, 10th.

Arizona.—Maricopa, 3d, 6th; Yuma, 3d, 10th; Fort Grant, 3d, 11th; Willeox, 7th, 11th; Fort Apache, 7th, 11th, 12th, 19th; Prescott, 8th, 9th, 11th, 12th.

Arkansas.—Lead Hill, 7th.

California.—San Francisco, 5th; Fort Bidwell, 10th; Oroville, 15th; Keeler, 17th.

Colorado.—Las Animas, 4th, 6th.

Connecticut.—North Colebrook, 3d; Bethel, 3d, 5th; New London, 9th, 12th.

Dakota.—Webster, 9th, 17th; Fort Totten, 10th, 11th; Bismarck, 10th, 14th, 15th.

Florida.—Pensacola, 2d; Cedar Keys and Manatee, 10th; Archer, 19th.

Georgia.—Forsyth, 7th, 20th; Augusta, 10th; Savannah, 13th.

Idaho.—Boisé City, 17th.

Illinois.—Springfield, 1st; Pekin, 1st, 3d, 11th, 18th; Riley, 1st, 5th; Chicago and Charleston, 16th.

Indiana.—Vevay, 1st, 8th, 10th, 14th, 15th, 20th; Terre Haute, 8th; Butlerville and Indianapolis, 8th, 14th; Laco-

Indian Territory.—Fort Sill, 10th.

Iowa.—Clinton, 2d, 12th, 16th; Muscatine, 11th.

Kansas.—Wyandotte, 4th to 7th, 9th, 13th, 16th; El Dorado, Globe, Emporia, Salina, West Leavenworth, and Wakefield, 9th; Westmoreland, 9th, 10th, 30th.

Kentucky.—Frankfort, 2d; Louisville, 8th; Richmond, 10th.

Louisiana.—Shreveport, 2d, 10th.

Maine.—Orono, 8th; Eastport, 12th.

Maryland.—Emmitsburg, 6th; Baltimore, 11th.

Massachusetts.—Deerfield, 3d, 5th; Blue Hill Observatory, Milton, and North Truro, 16th.

Michigan.—Kalamazoo, 3d; Alpena, 5th, 15th; Lansing, 11th, 15th; Mottville, 12th; Escanaba and Mackinaw City, 15th.

Minnesota.—Moorhead, 8th, 14th to 17th; Saint Vincent, 29th.

Montana.—Helena, 14th; Fort Custer, 17th.

Nebraska.—Marquette, 2d, 14th; Omaha and Genoa, 14th.

Nevada.—Carson City, 10th.

New Hampshire.—Nashua, 12th, 16th, 20th.

New Jersey.—Beverly, 2d, 3d, 5th, 10th, 11th, 13th; Moorestown, 2d, 3d, 5th; Clayton, 2d, 5th, 8th; Dover, 3d, 5th, 11th; Upper Montclair, 9th.

New Mexico.—Fort Stanton, 4th; Santa Fé, 5th.

New York.—Rochester, 2d; Albany, 3d; Buffalo, 8th; Palermo, 9th; Ithaca, 9th, 16th; Brooklyn, 11th; Oswego, 15th.

North Carolina.—New River Inlet, 3d, 25th; Smithville, 5th; Lenoir, 10th; Charlotte and Statesville, 10th, 14th.

Ohio.—Wauseon, 1st, 2d, 11th; Toledo, 1st, 2d, 11th, 15th; Garrettsville and Hiram, 2d; Elyria, 2d, 4th; Napoleon, 2d, 11th; Cincinnati, 14th.

Oregon.—Roseburg, 11th, 30th; Albany and Mount Angel, 13th; Linkville, 16th.

Pennsylvania.—Pittsburg, 2d; Philadelphia, 2d, 5th; Dyerberry, 2d, 5th, 9th; Grampian Hills, 2d, 11th; Fallsington, 3d, 5th; Catawissa, 11th.

Rhode Island.—Block Island, 11th.

South Carolina.—Spartanburg, 2d, 9th, 20th, 29th; Charleston, 9th; Aiken, 10th.

Tennessee.—Nashville, 8th, 10th; Memphis and Milan, 10th; Chattanooga, 14th, 27th, 29th.

Texas.—Palestine, 6th, 7th, 9th, 10th; Fort Davis, 6th, 10th; New Ulm, 9th, 10th; Corsicana, 10th; El Paso, 11th; Fort Elliott, 20th.

Utah.—Frisco, 11th.

Vermont.—Brattleborough, 6th.

Virginia.—Rappahannock, 1st, 3d, 11th; Dale Enterprise, 2d, 3d, 5th, 15th, 21st; Bird's Nest, 2d, 9th, 10th, 11th; Lynchburg, 3d, 5th, 6th, 9th, 10th; Cape Henry, 10th, 11th; Chincoteague and Norfolk, 11th.

Washington Territory.—Bainbridge Island, 10th; Port Angeles, 15th; Tatoosh Island, 17th.

Wisconsin.—Delavan, 5th, 6th, 15th; Beloit, 5th, 15th, 30th; Green Bay and Milwaukee, 15th.

Wyoming.—Fort Bridger, 13th, 14th, 18th.

The phases of the moon (Washington mean time) during November, as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: New moon, 25th, 2 h. 10.3 m.; first quarter, 2d, 23 h. 57.0 m.; full moon, 11th, 1 h. 58.3 m.; last quarter, 18th, 5 h. 32.2 m.; apogee, 5th, 1.4 h.; perigee, 20th, 14.2 h.

MIRAGE.

Mirages were observed at the following stations:

Webster, Dakota, 11th.

Richardton, Dakota, 17th.

Salina, Kansas, 6th, 8th, 9th, 13th.

Marquette, Nebraska, 17th to 20th.

Reidsville, North Carolina, 14th, 18th.

MISCELLANEOUS PHENOMENA.

DROUGHT.

Mobile, Alabama: light rain fell during the 9th and 10th, breaking one of the severest droughts ever experienced in this

section, very little rain having fallen since June; the soil had become baked by the sun while roads and streets were very dusty. Numerous wells and cisterns had become dry and rivers were low.

Keokuk, Iowa: the light rain that fell during the 21st and 22d was of great benefit to farmers, many of whose cisterns and wells had become dry. Along the line of the Chicago, Rock Island, and Pacific Railroad many farmers have been obliged to haul water four or five miles for the use of their stock.

Milledgeville, Georgia: from August 2d to November 30th only 5.59 inches of rain have fallen, a deficiency of nearly twelve inches as compared with the average.

Clinton, Clinton county, Iowa: November and the four preceding months have been remarkable for the small precipitation.

Yates Centre, Woodson county, Kansas, 30th: the total precipitation of the month is only 0.10 inch, in consequence of which the soil is exceedingly dry.

The following extracts are from a report prepared by E. C. Brandenburg, Private, Signal Corps, U. S. Army, at Saint Paul, Minnesota, on the drought which has prevailed throughout the Northwest during the past summer and autumn:

THE DROUGHT OF 1886 IN DAKOTA AND MINNESOTA.

The severe drought which has prevailed over the western portion of the country during the summer of 1886 has left its devastating effects on the upper Mississippi valley and the Northwest. Its influence was mostly felt in northwestern Minnesota and northeastern Dakota, being most severe and longest in the latter section. Other areas which suffered for shorter periods were northern Iowa, western Wisconsin, southeastern Minnesota, southwestern Dakota, and eastern Montana.

This paper will treat mainly on its effects in Minnesota and Dakota.

In these states the usual copious rainfall of May was lessened so considerably that the drought literally began to be appreciable in that month. The temperature was abnormally high, with a deficiency in rainfall of nearly one inch.

In the month of June the temperature was about normal, while the precipitation was nearly one and a half inches below the average in Minnesota, and about two inches below in Dakota.

In July the rainfall continued below the average, with the greatest deficiency occurring in eastern Minnesota and southern Dakota. At Duluth, Minnesota, the deficiency was 2.42 inches; La Crosse, Wisconsin, 3.08 inches; Huron, Dakota, 3.26 inches; and Yankton, Dakota, 3.28 inches. The temperature in Dakota was decidedly above the normal, at Huron being 5° 4 above and Bismarck 6° 0 above. In Minnesota it was also above the normal, with the mean temperature of the state 72° 2, while the average of the minimum temperatures was 50° 5. The temperature was phenomenally high during nearly the entire month, while at Sherburne and Spring Valley the maximum temperature was respectively 107° and 104°, which is about the greatest heat ever observed in this state.

In August there was an excess of over two inches of rainfall in the southeastern portion of Dakota, while in northern Dakota and Minnesota the rainfall was below the average; the deficiency being 3.1 inches at Saint Vincent and 2.5 inches at Moorhead. The temperature continued above the average with the maximum above a hundred degrees north to Saint Vincent where it rose as high as 108° 2.

September in eastern Minnesota brought an excess of rainfall, while there was a deficiency in western Minnesota and northern Dakota. The temperature was markedly below the normal at Duluth, while it was slightly above in southeastern Dakota.

In October the rainfall was slightly below the average, while the temperature was decidedly above. For Minnesota the mean temperature was 8° 7 above the mean of the corresponding month of 1885. The greatest departures from the normal were 8° above at Duluth, 6° above at Moorhead, Saint Vincent, Saint Paul, and Yankton, and 5° above at Huron.

In the following table are given the mean temperature and average precipitation, with their normals and departures, as taken from the MONTHLY WEATHER REVIEW for five months:

Districts.	May.			June.			July.		
	Average for a number of years.	Average for 1886.	Comparison with other years.	Average for a number of years.	Average for 1886.	Comparison with other years.	Average for a number of years.	Average for 1886.	Comparison with other years.
Extreme Northwest:									
Temperature.....	53.4	55.8	+2.4	61.8	62.8	+1.0	66.5	71.1	+4.6
Rainfall.....	2.87	1.83	-1.04	3.41	2.50	-0.91	3.14	2.64	-0.50
Upper Mississippi valley:									
Temperature.....	62.8	64.3	+1.5	71.3	70.6	-0.7	75.6	76.8	+1.2
Rainfall.....	4.25	3.51	-0.74	5.00	3.63	-1.37	4.16	0.70	-3.46

Districts.	August.			September.		
	Average for a number of years.	Average for 1886.	Comparison with other years.	Average for a number of years.	Average for 1886.	Comparison with other years.
Extreme Northwest:						
Temperature.....	65.2	66.6	+1.4	54.5	53.5	-1.0
Rainfall.....	2.71	1.85	-0.86	1.99	1.96	-0.03
Upper Mississippi valley:						
Temperature.....	73.3	75.3	+2.0	64.6	65.9	+1.3
Rainfall.....	3.50	2.90	-0.60	3.67	4.85	+1.18

Pastures became burned and brown early in the season and caught fire readily from sparks of passing trains. Those crops which yielded fairly well were favored with early rains and were past danger when the dry season began. The effect on newly seeded grass fields has been unusually severe, in many cases rendering the seeding of early spring worthless. Tree seeds in northern Dakota have become very scarce and are in great demand.

Sloughs, lakes, and rivers, which had the appearance of having been in existence for ages, have become dry, leaving the alluvial soil found in their bottoms to be baked by the burning sun, thus causing it to be cracked over an inch wide and many inches deep in some localities. Regions where there was but a thin layer of soil upon a gravel or stone bottom suffered far more from the drought than those favored by ground of clay formation.

Prairie fires were much more frequent and did greater damage than in previous years. The removing of the grass covering from the earth by these fires exposed its surface to the direct rays of the sun, thus allowing undue absorption of the moisture from the soil and leaving it in a dry condition. In localities well favored with forests the effects of the drought were largely modified and showers were generally more frequent, thus showing the great necessity of protecting those woodlands which so materially assist in moderating droughts and floods. Rain was also more frequent near large bodies of water and along large streams.

During the fall of 1885 and winter of 1885 and 1886, the fall of snow and rain was very light, and was followed by a summer marked by a decided deficiency of precipitation, which had the effect of drying sloughs, lakes, and rivers to an almost unprecedented extent, causing the ground in many localities to be as dry as dust to the depth of eight or nine feet. This, together with the lack of water all through the West and Northwest, could supply the atmosphere with but little moisture to be precipitated. The universally high temperatures which prevailed added very materially to the injurious effects of the dry weather.

Were it not for the great number of lakes found in this region, there being 7,000 to 10,000 alone in Minnesota, with an average of three hundred and twenty acres and upwards, and the forests and woodlands which cover one third of the state, there is no doubt but that the damage would have been far greater.

In some localities there seems to be a period of increase and decrease in the amount of water in lakes and rivers, while in other localities there seems to be a yearly decrease in the amount of water. *

In Minnesota the drought began in May and ended in August and September in the central and southern portions, while in the northern it continued quite severe until November 1st. In length it ranged from forty-one days in the southeastern portion of the state to over five months in the northern portion. *

In Dakota the drought began generally during the latter portion of June and was still existing November 1st. It seemed more severe in the western portion of the state; Wells and Stark counties reported the rainfall to be far below the average since July, 1885. The state has also suffered severely from prairie fires which devastated vast tracts of land; in the northern portion of the state forest fires have done irreparable damage. In some portions of the state trees planted several years ago are in a flourishing condition, showing that timber can be grown and will prove valuable both as a commercial article and as an assistant preventive of drought.

FOREST AND PRAIRIE FIRES.

Shelbyville, Shelby county, Illinois: on the 4th, in Holland township, an area of forest and farm land four miles long and two wide was burned over. Many barns, fences, and fields of corn were destroyed; the loss of property is estimated at several thousands of dollars.

Hamburg, Berks county, Pennsylvania: on the 16th, 17th, and 18th an extensive forest fire prevailed in the Blue Mountains near the town; the dry leaves allowed the flames to spread rapidly and much valuable timber was destroyed.

Petersburg, Dinwiddie county, Virginia: on the 18th, 19th, and 20th extensive forest fires were burning along the line of the Wilmington and Weldon Railroad, destroying much timber and cord wood as well as other property.

Clarendon, Donley county, Texas: on the 29th extensive prairie fires were burning over the country about twenty miles northwest of this town; one hundred thousand acres of pasture were destroyed.

Forest and prairie fires have also been reported from the following places:

Moorhead, Minnesota: prairie fires, 5th, 6th, 8th, 9th, 10th, 12th, 13th, 16th, 17th.

Pike's Peak, Colorado: extensive prairie fires were seen on the northeastern horizon on the 1st.

Alva, Florida: forest fires, 1st.

METEORS.

Little Rock, Arkansas: on the 2d, at 6.20 a. m., a brilliant meteor was seen moving across the sky from east to west through a course of about thirty degrees in ten seconds. During its passage it constantly dropped violet and orange-colored balls of fire.

Vineyard Haven, Massachusetts: a very brilliant meteor was observed at 10 p. m. of the 4th about midway between the zenith and the western horizon; it moved 30°, leaving a distinct trail of light, which was visible for several seconds.

New London, Connecticut: a large meteor passed across the sky from southeast to northwest at 9.50 p. m. of the 4th bearing a trail of light, which was visible about forty-five seconds. This meteor was also seen at Sandy Hook, New Jersey, where it seemed like the sudden flash of an electric light; it was followed by a trail of yellowish light, and moved in a sinuous course from northeast to southwest; the meteor was visible for ninety seconds, and faded away gradually.

Hay Springs, Sheridan county, Nebraska: on the 7th a very brilliant meteor was observed in the northeastern sky at an altitude of about 14°, moving rapidly, and followed by a long trail. The meteor disappeared in the north when about five degrees above the horizon.

The observer at Keeler, California, makes the following report in regard to a meteor seen by him on the 12th:

A brilliant meteor was observed at 9 p. m.; when first seen the altitude was 59°, azimuth, 45°; when last seen, altitude 42°, azimuth, 47°. This meteor is worthy of special mention, it being unusually large and brilliant. It resembled a ball ejected from a Roman candle, but appeared to be about twice as large. The meteor in the centre was of a pale bluish tint, deepening toward the edge to a dark purple. The cloud in its wake was shaped like an elongated ellipse, and appeared to be composed of an infinite number of points of light.

Fall River, Massachusetts: at 5.30 p. m. of the 16th a fine meteor was seen to pass from the zenith to the west; it was followed by a bright trail of light and burst into brilliant flames. A meteor was also seen at 6.50 p. m. of the 27th, moving from the zenith toward a point north of west; the meteor was about the size of a cocoanut and was followed by a long trail.

Fort Grant, Arizona: a large meteor, apparent diameter five inches, was visible for ten seconds at 11.10 p. m. of the 27th. When first seen it was about 20° north of west, and at an altitude of 30°. The meteor was of a brilliant blue and was followed by a train of light of the same color, and about eight degrees in length.

Meteors were also observed in the various states and territories, as follows:

California.—Nicolaus, 13th; Keeler, 17th, 22d, 25th; Los Angeles, 22d.

Connecticut.—New Haven, 5th.

Dakota.—Webster, 17th, 18th, 20th.

Florida.—Archer, 8th.

Georgia.—Savannah, 20th.

Illinois.—Pekin, 7th; Anna, 15th; Windsor, 27th, 28th.

Indiana.—Logansport, 15th; Vevay, 24th.

Iowa.—Cedar Rapids, 6th, 18th, 22d; Monticello, 12th, 13th, 16th, 19th; Muscatine, 13th.

Kansas.—Wakefield, 5th, 6th, 29th; Emporia, 11th to 14th; Manhattan, 19th.

Kentucky.—Richmond, 8th.

Maryland.—Woodstock, 2d, 8th, 14th, 15th, 18th, 19th, 20th, 26th, 28th.

Massachusetts.—Dudley, 4th; North Truro, 16th; Somerset, 20th.

Michigan.—Kalamazoo, 3d.

Nebraska.—Hay Springs, 17th.

New Hampshire.—Nashua, 1st, 2d.

New Jersey.—Beverly, 1st, 2d, 4th, 20th; Dover, 4th.

New York.—North Volney, 2d; West Point, Fort Columbus, and Factoryville, 4th; Setauket, 22d.

North Carolina.—Charlotte, 2d.

Ohio.—Tiffin, 2d, 3d, 23d, 24th; Yellow Springs, 2d, 4th, 24th.

Oregon.—East Portland, 3d, 6th, 9th; Mount Angel, 8th.

South Carolina.—Spartanburg, 2d, 4th, 5th, 10th.

Texas.—Brownsville, 3d, 4th, 5th.

Utah.—Salt Lake City, 6th.

Vermont.—Poultney, 22d.

Virginia.—Dale Enterprise, 15th, 27th; Variety Mills, 29th.

Wisconsin.—Beloit, 3d, 5th.

MIGRATION OF BIRDS.

Geese flying southward.—Lead Hill, Arkansas, 4th; Little Rock and Fort Smith, Arkansas, 5th; Cape Henlopen, Delaware, 25th; Augusta, Georgia, 2d, 22d, 24th, 28th; Charleston, Illinois, 11th, 12th; Butlerville, Indiana, 3d; Fort Reno, Indian Territory, 5th; Muscatine, Iowa, 10th; Keokuk, Iowa, 14th; Cedar Rapids, Iowa, 17th; Independence, Kansas, 8th, 9th; Yates Centre, Kansas, 28th; Amherst, Massachusetts, 27th; Mottville, Michigan, 29th; Moorhead, Minnesota, 6th; Lamar, Missouri, 15th, 21st, 27th; Poplar River, Montana, 4th; Fort Assinaboine, Montana, 6th; New River Inlet, North Carolina, 19th; Kitty Hawk, North Carolina, 28th; Garrettsville, Ohio, 3d, 13th; Wauseon, Ohio, 7th; Linkville, Oregon, 5th, 8th; Wellsborough, Pennsylvania, 6th, 12th; Corsicana, Texas, 5th; Cape Henry, Virginia, 15th; Embarras, Wisconsin, 5th.

Geese flying northward.—Yankton, Dakota, 17th; Augusta, Georgia, 24th; Keokuk, Iowa, 13th; Independence, Kansas, 22d; Brownsville, Texas, 14th, 20th; Wauseon, Ohio, 5th; Linkville, Oregon, 11th; Chattanooga, Tennessee, 28th.

Ducks flying southward.—Fort Smith, Arkansas, 5th; Charleston, Illinois, 29th; Butlerville, Indiana, 27th; New River Inlet, North Carolina, 7th, 13th; Kitty Hawk, North Carolina, 17th, 28th; Wauseon, Ohio, 4th; Memphis, Tennessee, 6th, 16th; Cape Henry, Virginia, 17th.

POLAR BANDS.

Polar bands were reported from the following stations:

California.—Keeler, 9th.

Colorado.—Montrose, 6th, 17th, 18th, 23d.

Connecticut.—North Colebrook, 15th.

Florida.—Archer, 10th, 16th, 17th, 19th, 20th, 30th; Limona, 27th.

Illinois.—Riley, 4th, 11th, 20th.

Kansas.—Salina, 4th, 5th, 9th, 17th; Yates Centre, 8th, 30th; Ninneseah, 28th.

Massachusetts.—Somerset, 24th.

New Jersey.—Moorestown, 22d; Beverly, 28th.

New York.—New York City, 24th.

Ohio.—Wauseon, 11th, 19th; Napoleon, 11th, 16th, 20th, 26th.

Tennessee.—Nashville, 7th; Memphis, 20th.

Virginia.—Dale Enterprise, 11th, 16th.

Washington Territory.—Bainbridge Island, 18th.

Wyoming.—Prairie du Chien, 1st, 2d, 5th, 11th.

SAND STORMS.

Fort Assinaboine, Montana: on the 3d clear weather and high wind from the southwest and west prevailed; maximum velocity, forty-eight miles per hour, between 3 and 4 p. m. The gale was accompanied by clouds of sand which nearly obscured the sky.

Fort Buford, Dakota: on the 4th a heavy gale set in at 1 a. m. and continued until 6 p. m.; maximum velocity, fifty-two

miles per hour from the northwest, at noon. During the prevalence of the gale the air was filled with heavy clouds of dust and sand.

Keeler, California: on the 14th high wind set in shortly after 11 p. m. and reached before midnight a velocity of thirty miles per hour; the storm continued throughout the night and until sunset of the 15th; maximum velocity, thirty-nine miles per hour from the northwest, at 4.20 a. m. The storm raised great clouds of sand which nearly obscured the sky and rendered objects one-half a mile distant indistinguishable.

Sand storms also occurred at the following stations:

Yuma, Arizona, 10th, 15th, 16th.

Fort McDowell, Arizona, 15th, 21st.

Fort Yates, Dakota, 4th.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and fifty-eight stations show 4,730 observations to have been made, of which one was reported doubtful; of the remainder, 4,729, there were 4,222, or 89.3 per cent., followed by the expected weather.

SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for November, 1886:

Date— November, 1886. Standard time.	No. of new.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 11 a. m.	0	0	0	0	0	0	0	0	
1, 9 a. m.	0	0	0	0	0	0	0	0	
5, 3 p. m.	0	0	0	0	0	0	0	0	
7, 12 m.	0	0	0	0	0	0	0	0	
8, 11 a. m.	0	0	0	0	0	0	0	0	
12, 12 m.	0	0	0	0	0	0	0	0	
14, 11 a. m.	0	0	0	0	0	0	0	0	
15, 3 p. m.	0	1	0	0	0	1	0	1	
19, 11 a. m.	0	0	0	0	0	0	0	0	
20, 1 p. m.	0	0	0	0	0	0	0	0	
22, 11 a. m.	0	0	0	0	0	0	0	0	
24, 12 m.	0	0	0	0	0	0	0	0	
26, 9 a. m.	0	0	0	0	0	0	0	0	
27, 1 p. m.	0	0	0	0	0	0	0	0	

Faculae were seen at the time of every observation.

VERIFICATIONS.

INDICATIONS.

The predictions for November, 1886, were made by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for November, 1886, with the telegraphic reports of the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 75.29. The percentages for the different elements are: Weather, 77.42; wind, 72.02; temperature, 73.44. By states, etc., the percentages are: For Maine, 70.86; New Hampshire, 72.69; Vermont, 72.75; Massachusetts, 72.36; Rhode Island, 74.53; Connecticut, 74.62; New York, 80.17; Pennsylvania, 76.22; New Jersey, 80.56; Delaware, 76.64; Maryland, 76.81; District of Columbia, 73.92; Virginia, 76.44; North Carolina, 82.39; South Carolina, 77.50; Georgia, 81.90; Florida, 79.92; Alabama, 75.89; Mississippi, 72.19; Louisiana, 76.28; Texas, 82.31; Arkansas, 72.47; Tennessee, 67.58; Kentucky, 70.25; Ohio, 76.78; West Virginia, 69.14; Indiana, 73.72; Illinois, 73.92; Michigan, 76.14; Wisconsin, 73.83; Minnesota, 73.56; Iowa, 76.58; Kansas, 76.17; Nebraska, 73.58; Missouri, 75.56; Colorado, 74.92; east Dakota, 73.50.

There were four omissions to predict, out of 9,630, or 0.04 per cent. Of the 9,626 predictions that have been made, seven hundred and seventy, or 8.00 per cent., are considered to have entirely failed; six hundred and eight, or 6.32 per cent.,

were one-fourth verified; 1,665, or 1.730 per cent., were one-half verified; 1,664, or 17.29 per cent., were three-fourths verified; 4,919, or 51.10 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Below are given for the Pacific coast the percentages of indications for October, 1886; this data was prepared too late for publication in the October REVIEW. The predictions were made by 2d Lieutenant W. A. Glassford, Signal Corps, U. S. Army, Assistant; they were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant. The percentages for the different districts are: Washington Territory, 72.44; Oregon, 70.44; northern California, 74.82; southern California, 77.32.

CAUTIONARY SIGNALS.

During November, 1886, the total number of signals ordered of all kinds, the verifications of which were determined, was three hundred and six, of these, two hundred and twenty-two, or 72.55 per cent., were fully verified both as to direction and velocity. Number of signals ordered for on-shore winds, one; verified, one. Number of signals ordered for northeast winds, thirty-six; verified both as to direction and velocity, twenty-four, or 66.67 per cent.; verified as to velocity only, seven, or 19.44 per cent. Number of signals ordered for southeast winds, sixty; verified both as to direction and velocity, forty, or 66.67 per cent.; verified as to velocity only, nine, or 15.00 per cent. Number of signals ordered for southwest winds, sixty-eight; verified both as to direction and velocity, sixty-one, or 89.71 per cent.; verified as to velocity only, four, or 5.88 per cent. Number of signals ordered for northwest winds, one hundred and eighteen; verified both as to direction and velocity, eighty-two, or 69.49 per cent.; verified as to velocity only, six, or 5.08 per cent. Number of signals ordered for winds without regard to direction, twenty-three; verified, fourteen, or 60.87 per cent. Number of signals ordered late, *i. e.*, after the verifying velocity had begun, four, or 1.31 per cent.

In forty-two instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in twenty-one instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

In addition to the above, six hundred and ninety-three signals were ordered at display stations, the verifications of which it was impracticable to determine.

COLD-WAVE SIGNALS.

During November, 1886, the total number of cold-wave signals ordered, the verifications of which were determined, was two hundred and forty-two; number verified, one hundred and ninety-three, or 79.75 per cent. Thirty-six signals were ordered, the verifications of which it was impracticable to determine. In addition to the above, in five hundred and thirty instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verification of these it was impracticable to determine.

RAILWAY WEATHER SIGNALS.

P. H. Mell, jr., director of the "Alabama Weather Service," in the report for November, 1886, states:

The verification of predictions for the whole area was 80 per cent. for temperature, and 85 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

The following is from the "Bulletin of the New England Meteorological Society" for November, 1886:

Verification of weather signals at New Haven was 83 per cent. for temperature, 90 for weather; at five stations reporting to the Signal Office in Boston, 88.4 for temperature, 88.0 for weather. Local sunset predictions at Blue Hill for twenty-four hours from midnight were verified 77 per cent.; predictions at 8 a. m. for sixteen hours, 90 per cent. The Signal Service indications had a local verification of 70 per cent. Three cold-wave warnings were justified.

Meteorological record of voluntary observers and Army post surgeons, November, 1886.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature.				Rainfall.	Stations.	Temperature.				Rainfall.
	Maximum.	Minimum.	Mean.				Maximum.	Minimum.	Mean.		
<i>Alabama.</i>						<i>Iowa.</i>					
Greensborough.....	74	31	54.3	4.53		Bancroft.....	71	4	37.6	1.90	
Livingston.....	79	31	55.2	5.79		Cedar Rapids.....	69	8	33.6	1.50	
Mount Vernon B'ks.....	81	37	57.3	7.03		Cedar Rapids.....	68	1	30.8	0.90	
<i>Arizona.</i>						Clinton.....	75	7	33.0	1.00	
Huachuca, Fort.....	79	15	54.4	trace		Cresco.....	65	1	26.8	1.86	
Lowell, Fort.....	86	15	53.8	0.12		Des Moines.....	64	5	35.1	0.96	
McDowell, Fort.....	89	22	53.9	0.30		Independence.....	70	3	31.3	0.30	
Tucson.....				0.45		Logan.....	74	3	31.3	2.30	
<i>Arkansas.</i>						Monticello.....	68	0	31.7	1.35	
Lead Hill.....	79	19	45.2	3.49		Mount Vernon.....	70	6	33.2	1.35	
<i>California.</i>						Muscatoine.....	72	9	33.7	0.95	
Alcatraz Island.....	72	44	54.4	1.02		Oakalaosa.....	72	8	31.4	1.30	
Anderson.....	86	30	49.0	0.50		Oakalaosa.....	70	6			
Angel Island.....	82	39	55.5	0.73		West Union.....	70	2	29.2	1.36	
Benicia Barracks.....	69	39	52.0	0.30		<i>Kansas.</i>					
Bidwell, Fort.....	59	11	35.5	0.47		Allison.....	67	1	30.5	1.05	
Cahuenga.....				0.72		Belleville.....	70	17	43.3	0.88	
Hydesville.....				1.97		Elk Falls.....				0.66	
Mason, Fort.....	68	47	54.7	0.72		Globe.....	74	15	41.1	0.98	
Nicolaus.....	76	31	52.0	0.04		Emporia.....	76	12	39.0	1.57	
Oakland.....	69	38	52.2	0.45		Hays, Fort.....	75	4	35.5	0.68	
Orville.....	70	31	53.8	0.29		Independence.....	74	13	43.9	1.70	
Poway.....	83	38	54.1	1.50		Manhattan.....	80	8	35.7	1.30	
Presidio of San F.....	74	41	54.3	0.48		Manhattan.....	79	12	40.6	1.24	
Princeton.....	83	36	49.0	0.02		Ninnescah.....	73	13	40.5	0.18	
Riverside.....	84	27	54.5	0.53		Riley, Fort.....	77	10	39.8	0.80	
Sacramento.....	68	27	46.0	0.11		Salina.....	64	18	40.9	0.97	
Salinas.....	80	30	49.2	0.82		Wellington.....	70	5	43.2	0.10	
Santa Barbara.....	83	38	50.3	0.87		West Leavenworth.....	77	10	36.0	0.56	
Santa Maria.....	85	32	56.0	0.59		Wakefield.....	75	16	39.5	1.06	
<i>Colorado.</i>						Wyandotte.....	76	12	39.9	1.26	
Lewis, Fort.....	59	13	27.6	1.74		Yates Centre.....	73	11	38.8	1.34	
<i>Connecticut.</i>						<i>Kentucky.</i>					
Bethel.....				4.41		Bowling Green.....	73	30			
Hartford.....	65	18	40.8	6.32		Frankfort.....	70	16	41.8	6.18	
North Colebrook.....	64	12	35.2	2.55		Richmond.....	70	19	42.6	4.34	
Voluntown.....	68	24		4.30		<i>Louisiana.</i>					
<i>Dakota.</i>						Grand Coteau.....	79	32	57.5	3.94	
Abr. Lincoln, Fort.....	63	11	24.7	0.40		Liberty Hill.....				3.01	
Henry.....	58	3	24.0	0.49		<i>Maine.</i>					
Meade, Fort.....	50	13	30.6	1.60		Bar Harbor.....	58	24		5.74	
Penobscot, Fort.....	58	20	18.9	3.80		Cornish.....	62	14	35.2	4.78	
Randall, Fort.....	57	1	32.3	1.04		Gardiner.....	61	18	37.7	6.06	
Richardson.....	58	3	25.1	0.80		Kent's Hill.....	60	14	35.1	4.35	
Shimston, Fort.....	60	17	24.4	0.96		Orono.....	58	14	37.0	8.67	
Sully, Fort.....	66	1	30.8	1.72		<i>Maryland.</i>					
Totten, Fort.....	54	12	20.8	0.65		Emmitsburg.....	70	20	42.0	2.95	
Vermillion.....	72	1		2.50		Fallston.....	70	23	43.1	4.19	
Webster.....	63	16	23.0	4.33		New Midway.....	72	34	45.3	5.10	
Yates, Fort.....	61	21	20.9	0.58		McHenry, Fort.....	70	28	40.4	2.30	
<i>District of Columbia.</i>						Woodstock.....	68	17	44.0	3.50	
Kendall Green.....	68	23	50.4	2.44		<i>Massachusetts.</i>					
<i>Florida.</i>						Amherst.....	65	16	38.3	5.25	
Archer.....	86	32	60.7	1.08		Amherst.....	65	24	40.2	4.72	
Alva.....	82	43	62.0	0.30		Blue Hill Obs'y.....	63	22	40.1	3.16	
Meade, Fort.....				0.40		Deerfield.....	65	17	39.0	5.65	
Limona.....	88	42	66.1	1.02		Dudley.....	68	10	40.6	3.66	
Manatee.....	88	42	66.0	0.92		Fall River.....	65	25	43.4	4.90	
Tallahassee.....	79	33	57.4	2.20		Heath.....	64	10			
<i>Georgia.</i>						Milton.....	62	22	39.4	3.13	
Athens.....	72	27	50.4	3.61		New Bedford.....	62	22	43.3	3.74	
Forsyth.....	82	33	56.4	4.55		North Truro.....				3.70	
Milledgeville.....	79	29	52.8	2.88		Princeton.....	64	19	37.6	5.55	
Quitman.....	79	32		1.90		Somerset.....	68	22	43.6	4.49	
<i>Idaho.</i>						Taunton.....	70	31	42.0	3.95	
Boise Barracks.....	61	10	35.3	0.36		Westborough.....	70	18	41.7	4.82	
Coeur d'Alene, Fort.....	59	0	31.9	1.52		Williamstown.....	65	14	38.9	5.80	
<i>Illinois.</i>						Worcester.....	63	22	38.0	5.19	
Anna.....	74	22	44.2	6.65		<i>Michigan.</i>					
Collinsville.....	73	18	45.5	2.74		Brady, Fort.....	70	4	29.8	1.44	
Charleston.....	74	14	38.9	3.80		Harrisville.....	62	10		2.34	
Geneseo.....	73	9	34.3	0.76		Hudson.....	70	10		2.15	
Mattoon.....	76	15	40.5	2.65		Kalamazoo.....	66	11	38.5	1.36	
Pekin.....	72	11	38.6	0.87		Lansing.....	68	5	34.0	1.37	
Peoria.....	72	17	29.6	1.34		Mottville.....	70	15		0.75	
Riley.....	65	9	31.3	0.98		Pontwater.....	67	15	34.5	2.91	
Rockford.....	67	12	32.9	1.61		Thornville.....	70	9	35.3	2.01	
Sandwich.....	70	11	34.6	1.47		Traverse City.....	70	3		3.84	
South Evanston.....	71	9		0.96		<i>Minnesota.</i>					
Sycamore.....	67	9	32.1	0.96		Minneapolis.....	68	3	26.2	2.48	
Windsor.....	72	16	38.2	2.37		Snelling, Fort.....	69	12	26.8	1.82	
<i>Indian Territory.</i>						<i>Missouri.</i>					
Gibson, Fort.....	79	10	47.2	0.50		Centerville.....	71	13		5.83	
Supply, Fort.....	75	6	42.8	0.10		Central College.....	71	17		1.85	
<i>Indiana.</i>						Conception.....	72	8	36.6	1.39	
Butterville.....	76	17	41.7	4.90		Pierce City.....	76	17	43.1	1.80	
Fort Wayne.....	71	18	44.5	3.05		<i>Montana.</i>					
Jeffersonville.....	73	22	42.7	5.85		Keogh, Fort.....	62	17	31.2	0.40	
Lafayette.....	80	18	41.4	5.42		Missoula, Fort.....	53	8	25.9	0.50	
Lafayette.....	72	9	37.3	1.87		Shaw, Fort.....	58	21	33.0		
La Grange.....	68	14	34.5	2.00		<i>Nebraska.</i>					
Logansport.....	74	16	38.9	3.71		Brownville.....	74	12	38.9	2.00	
Manx.....	67	9	31.6	4.17		Crete.....	74	6	32.9	0.50	
Monticello.....	70	11		0.05		De Soto.....	73	4	33.3	1.70	
Spiceland.....				3.00		Fremont.....	71	8	31.6	1.92	
Sunman.....	66	12	37.8	5.10		Genoa.....	70	5	32.2	1.43	
Terre Haute.....	67	18		3.42							
Vevay.....	75	19	42.7	4.54							

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature.				Rainfall.	Stations.	Temperature.				Rainfall.
	Maximum.	Minimum.	Mean.				Maximum.	Minimum.	Mean.		
<i>Nebraska—Cont'd.</i>						<i>Oregon.</i>					
Hay Springs	54	0	26.3	2.19		Albany	62	24	43.2	1.75	
Lincoln	80	0	34.9			Bandon	59	26	43.0	2.27	
Marquette				0.79		East Portland	56	26		1.00	
Niobrara, Fort	65	4	29.6	0.60		Eola	54	26	41.1	1.45	
Robinson, Fort	72	107	31.8	1.12		Klamath, Fort	68	5	31.1	0.23	
Sidney, Fort	58	1	29.2	0.16		Mount Angel	60	24	41.5		
Stockham				1.10		<i>Pennsylvania.</i>					
Tecumseh	72	8	37.6	0.80		Bloomington	70	9	37.4	7.00	
<i>Nevada.</i>						Catawissa	71	10	39.8	5.82	
Carson City	60	4	32.7	0.44		Drifton	69	10	37.2	6.52	
McDermitt, Fort	54	10	31.6	0.76		Dyberry	61	3	36.6	7.10	
<i>New Hampshire.</i>						Fallingington	71	21	42.1	4.72	
Antrim				6.15		Franklin	63	8	30.9	4.49	
Ashland				6.11		Grampian Hills	64	8	35.2	6.03	
Belmont				4.87		Phillipsburg	63	10	35.1	5.70	
Berlin Mills	60	2				Wellsborough	63	10	39.0	0.50	
Bristol				6.38		West Chester	72	30	42.8	4.48	
Lake Village				5.22		Wilkesbarre	70	13	39.4	5.80	
Nashua	64	16	38.5	4.66		York	85	20		9.50	
Wier's Bridge				4.63		Zionsville	80	30	42.8	6.06	
Wolfsborough				5.10		<i>South Carolina.</i>					
Woodstock				6.13		Aiken	78	31	56.0	1.83	
<i>New Jersey.</i>						Kirkwood	72	22	48.3	0.92	
Beverly	71	22	43.8	4.04		Pacolet	71	30	48.4	3.04	
Clayton	72	20	43.7	5.03		Spartanburg	61	40	47.7	4.50	
Dover	76	17	38.9	4.47		Stateburg	73	30	53.7	0.87	
Moorestown	73	22	43.0	4.21		<i>Tennessee.</i>					
Paterson	50	32	43.0	3.85		Ashwood	72	22	47.0	5.13	
Roseland				4.02		Austin	74	19	47.1	6.30	
South Orange	72	26	43.3	4.12		Milan	70	22	40.3	8.05	
Upper Montclair	67	20	42.9	3.38		<i>Texas.</i>					
Vineland	68	24	44.1	3.80		Austin	84	24		0.64	
<i>New Mexico.</i>						Comfort				0.16	
Bayard, Fort	79	17	44.9	0.00		Concho, Fort	85	21	52.7	0.00	
Gallinas Spring	68	24				Corcoran				2.59	
Gelden, Fort	75	15	45.1	0.60		Midland	78	19	42.7		
Union, Fort	65	6	35.8	0.35		McIntosh, Fort	86	27	59.7	trace	
Wingate, Fort	64	0	31.0	0.46		Ringgold, Fort	91	26	65.5	0.48	
<i>New York.</i>						New Ulm	87	28	58.7	1.50	
Auburn	65	21	37.9	6.89		Silver Falls	78	12		0.03	
Brooklyn	76	29	45.2	3.92		<i>Vermont.</i>					
Columbus, Fort	70	27	45.1	4.04		Brattleborough	67	14	37.4	5.67	
Cooperstown	64	16	35.5	4.72		Burlington	67	20	36.1	4.29	
Factoryville	64	9	36.2	4.77		Charlotte	68	20	44.8	5.80	
Humphrey	68	15	36.6	6.23		Lunenburg	58	10	33.3	3.90	
Ithaca	67	15	37.6	6.03		Newport	62	5	33.5	7.80	
Le Roy	69	12	35.7	5.32		Port Mills	66	6	31.2	6.45	
Madison Barracks	65	12	37.3	3.00		Poultney	70	7	36.0	7.75	
Menand	67	20	39.1	5.25		Straford	60	22	37.9	4.97	
Niagara, Fort	65	22	38.5	2.44		<i>Virginia.</i>					
North Volney	70	21	36.8			Accotink	72	22	44.8	2.85	
Palermo	63	18	34.8	4.31		Bird's Nest	79	29	53.3	2.75	
Penn Yan				4.49		Bruington				4.07	
Palmyra	68	18	37.1			Dale Enterprise	78	21	44.4	6.46	
Setauket	67	27	45.4	3.43		Monroe, Fort	74	30	52.2	1.55	
West Point	70	19	42.4	4.30		Rappahannock	80	24	50.3	3.98	
<i>North Carolina.</i>						Snowville	63	21		4.70	
Chapel Hill	77	24	49.1	2.79		Summit	70	19	44.0		
Flat Rock	67	22	43.8	8.51		Variety Mills	69	18	42.5	3.81	
Lenoir	66	22		5.90		<i>Washington Territory.</i>					
Lincolnton	67	26	43.7	4.37		Bainbridge Island	62	28	44.7	1.80	
Raleigh	78	30	52.0	1.05		Kenewick	65	8		0.04	
Reidsville	72	15	38.2	1.26		Spokane, Fort	63	6	32.3	0.06	
Statesville	70	25	46.3	5.01		Tacoma	58	29	40.5	1.59	
Wake Forest	75	22	51.2	2.11		Townsend, Fort	60	28	44.0	1.28	
<i>Ohio.</i>						Walla Walla, Fort	71	18	40.4	0.57	
Cleveland	81	30	39.0	4.59		<i>West Virginia.</i>					
College Hill	73	14	41.8	4.50		Clarksburg	71	18	40.8	2.93	
Elyria	73	20		4.31		Helvetia	69	17	39.5	4.53	
Garrettsville	70	12	34.9	4.94		Parkersburg	70	24	40.8	4.78	
Hiram	68	18	36.0	5.68		<i>Wisconsin.</i>					
Jacksonborough	62	18	38.2	4.55		Beloit	66	10	32.6	1.15	
Napoleon	60	12	39.2	2.97		Delavan	63	5	32.4	1.19	
North Lewisburg	69	16	39.5	4.30		Embarras	68	4	30.4	3.65	
Portsmouth	72	23	42.5	5.22		Fond du Lac	67	12	26.1	1.61	
Ruggles	68	20	37.7	4.60		Madison	49	9	31.2	1.21	
Tiffin	66	21	37.3	3.49		Manitowoc	56	3	32.9	2.47	
Tiffin	69	30	35.0	4.47		Prairie du Chien	70	8	31.5	1.13	
West Milton	75	16	42.4	6.00		Wausau	65	3	36.1	2.32	
Wausau	71	17	34.9	2.66		<i>Wyoming.</i>					
Westerville	67	18	38.2	3.22		Laramie, Fort	53	6	30.5	0.55	
Yellow Springs	65	16	36.7	3.11		Washakie	54	19	23.6	2.29	

were reported by Mount Willing on the 10th, at 10.30 p. m., during a high pressure; by Newton on the 17th; and by Tusculumbia on the 16th, at 8 p. m., with a precipitation of 2.42 inches within thirteen hours. Tusculumbia also reported a strong wind on the 23d.

In the autumn just closed the temperature was 1° 9 below the normal, and the precipitation was 3.45 inches below the normal—indicating a dry autumn.

Summary.

Mean temperature, 52° 2; highest temperature, 84°, at Fayette, on the 3d; lowest temperature, 18°, at Gadsden, on the 19th; range of temperature, 66°; greatest monthly range of temperature, 56°, at Fayette; least monthly range of temperature, 36°, at Union Springs; mean daily range, 16° 3; greatest daily range of temperature, 49°, at Oswichee, on the 1st; least daily range of temperature, 0°, at Centre, on the 21st, and at Greenville, on the 12th.

Mean depth of rainfall, 5.03 inches; mean daily rainfall, 0.168; greatest depth of monthly rainfall, 11.55 inches, at Mount Willing; least depth of monthly rainfall, 3.27 inches, at Tuscaloosa; greatest daily local rainfall, 3.50 inches, at Mount Willing, on 17th.

Average number of days on which rain fell, 9; average number of cloudy days, 10; average number of fair days, 9; average number of clear days, 11.

Warmest day, 23d; coldest day, 19th.

Prevailing directions of wind, south and southwest.

The following is an extract from the November, 1886, report of the "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

Districts.	Temperature.			Average precipitation.
	Highest.	Lowest.	Monthly means.	
Northern counties	73.0	11.0	36.2	2.95
Central counties	73.5	9.0	37.4	4.04
Southern counties	77.0	13.0	41.3	5.03
State	77.0	9.0	38.3	4.01

The mean temperature of the state for November, 1886, was 3° below the mean of November for the past five years; 2° 6 below the mean of sixteen years at Indianapolis; 1° 7 below the mean of thirty-one years at Logansport; 5° 6 below the mean of twenty-one years at Vevay; 0° 4 below the mean of thirty-three years at Spiceland; 0° 1 above the mean of seven years at Maury; 5° 4 below the mean of nine years at Blue Lick; 10° 6 below the mean of five years at Worthington; 3° 1 above the mean of seven years at Lafayette.

The mean precipitation of the state for November, 1886, is 0.87 inch above the mean of November for the past five years; 0.32 inch above the mean of sixteen years at Indianapolis; 1.07 inches above the mean of thirty-one years at Logansport; 0.90 inch above the mean of twenty-one years at Vevay; 0.98 inch above the mean of twenty-eight years at Spiceland; 0.30 inch above the mean of seven years at Maury; 0.31 inch above the mean of five years at Blue Lick; 0.08 inch above the mean of five years at Worthington; 1.28 inches above the mean of seven years at Lafayette.

Frosts are reported on every day except the 3d, 9th, 10th, 11th, 12th, 17th, and 20th.

The high wind of the 18th was prevalent in the central and southern parts of the state.

The following is an extract from the November, 1886, report of the "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, of Springfield, director:

The state covers such an extended area from north to south (385 miles) that it has been found advisable to divide the same and follow the judicial divisions, which include the following territory, viz: the northern division extends from 42° 30' to about 40° 31'; the central division extends from about 40° 31' to about 39°; the southern division from about 39° to 36° 51'.

Temperature.—The mean temperature of the state for the month, 38° 6, was 0° 6 below the normal for the past twelve Novembers. The mean temperature of the northern division was 35°; of the central division, 38° 8, and of the southern division, 41° 8. The temperature was below the normal in all but four of the sixty-three counties reporting. It averaged 1° 9 below in the northern division; 1° 3 below in the central division, and 1° 5 below in the southern division.

Saint Clair county, Saint Louis, Missouri, reported a departure of 2° 0 above the normal for the month; Coles county, Mattoon, 0° 3 above; Peoria county, Peoria, 0° 1 above, and Sangamon county, Springfield, the normal.

The greatest departures below the normal are as follows: McHenry county, Marengo, 2°; DeKalb county, Sycamore, 3° 7; Ford county, Melvin, 2° 3; Champaign county, Philo, 2° 3; Christian county, Pana, 3°; Crawford county, Palestine, 3° 1; Bond county, Greenville, 4°; Hamilton county, McLeansborough, 2° 6.

The highest temperature prevailed on the 1st and 2d, and the lowest on the 25th and 26th.

The highest temperature reported for the month was 78°, at Fairfield, Wayne county, on the 2d, and the lowest, 6°, at Camden, Schuyler county, on the 30th.

Precipitation.—The average precipitation for the state for the month was

3.04 inches; for the northern division, 1.28 inches; for the central division, 2.04 inches, and for the southern division, 5.45 inches. It was 0.07 of an inch below the November normal for the state; 1.10 inches below for the northern division; 0.73 of an inch below for the central division, and 1.35 inches above for the southern division.

The distribution of precipitation was very unequal throughout the state. Portions of the northern and central divisions dread the coming winter owing to the scarcity of water, while the southern division has a plentiful supply.

The most marked departures from the November normal are as follows: *Below the normal:* DeKalb county, Sycamore, 2.04 inches; La Salle county, Ottawa, 2.06 inches. *Above the normal:* Wabash county, Mount Carmel, 2.29 inches; Hamilton county, McLeansborough, 2.58 inches; Union county, Anna, 2.34 inches.

The snowfall averaged 5.9 inches for the state for the month; 1.8 inches for the northern division; 6.4 inches for the central division, and 8.9 inches for the southern division. The total snowfall for the month ranged from 0.5 inch in Livingston county, Pontiac, to 17.5 in Clay county, Flora. General snows fell on the 29th and 30th.

The greatest monthly precipitation reported was 8.40 inches in Lawrence county, Sumner, and the least, 0.50 inch in Menard county, Petersburg.

The following is from the advance bulletin (November, 1886) of the "Iowa Weather Service," Dr. Gustavus Hinrichs, director; central station at Iowa City:

November, 1886, was cold, northwesterly winds prevailing; precipitation was moderate, excepting one heavy snowfall in the northwest.

The mean temperature of the air was one and a half degrees below normal. During the last sixteen years November has been as cold or colder ten times, the coldest being that of 1880, which was eight degrees below normal. The first decade was nearly two degrees above normal; the second was fully that much below normal, and the third decade was very wintry, being nearly four degrees below normal.

The first half of the month was fair, warm, and dry, being one degree above normal; frosty mornings and hazy days were common; precipitation was very light and consisted of rain only. The last half of the month was cloudy, cold, and stormy, being three degrees below normal in temperature; heavy snow storms and blizzards occurred, completely stopping field work and temporarily blocking railroads in the north.

While cold, no extreme low temperatures were attained. At the central station the lowest temperature recorded this November was eight degrees above zero, while in November of 1871 and 1875 the thermometer descended to ten below zero.

The most remarkable storm of the month set in with northeasterly winds on the 15th, brought rain in the south and abundant snow in the north on the 16th, was marked by snow and high winds on the 17th, and followed by decidedly colder, clearing weather on the 18th.

The total precipitation was less than normal; at the central station only a little over one inch fell, which is but 42 per cent. of the normal amount. During the last sixteen years, only in 1875 and 1878 was the amount less than this. The entire eastern half of the state received only about one inch of water, while the west averaged over two inches of rain and melted snow. The highest precipitation, exceeding five inches of water, is reported from Onawa; the lowest, not quite half an inch, fell at Waterloo. The most abundant precipitation occurred in central-eastern Iowa on the 22d, throughout the balance of the state on the 16th and 17th.

The only thunder-storm of the month occurred on the 22d in northern Iowa; on this warm day a fog extended over nearly the entire state.

The following is from the November, 1886, report of the "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The mean daily temperature was generally above freezing until the 16th, when the first severe cold wave of the season moved southward from Manitoba and lowered the temperature throughout this region considerably below freezing, and below zero in the northwestern portion of the state. From the 16th the temperature continued low, while at the close of the month it was decidedly colder, being below zero south to Saint Paul. The mean temperature for the state was 26° 9, which is 5° 2 below that of the corresponding month of 1885, while the mean is but slightly lower than the average for a number of years. The greatest departure was 2° 0 below the average of sixteen years, and occurred at Saint Paul. At other stations the deviation from the normal did not exceed one degree. The range of temperature was very marked, while November, 1885, was distinguished by a slight range. The average range was 70° 5, while in November, 1885, it was but 40° 7. The stations having the greatest monthly range of temperature were Sherburne, Saint Paul, and Saint Vincent, where it was 80° 0, 76° 9, and 75° 7, respectively. Stations having the least range were La Crosse, 61° 1, and Winona, 63°. The maximum temperatures for the month occurred generally on the 1st; the highest was 73° 6, at Saint Paul, while the lowest observed was 17° 7 below zero, at Saint Vincent, on the 25th, thus making the range for the state 91° 3.

The precipitation was not regularly distributed, as in the extreme northwestern portion of the state the fall was but slightly over one-half an inch, which is about the average, while to the south, at Moorhead, there was an excess of 1.40 inches. In the eastern portion of the state the fall amounted to about two inches, which is an excess of one inch at Duluth, and 0.74 inch at Saint Paul. The average precipitation for the state was 1.69 inches, which is

nearly an inch more than the average of November, 1885. The greatest monthly precipitation was 2.84 inches at Duluth, and 2.72 inches at Rochester, while the least fall was 0.52 inch, at Saint Vincent, and 0.69 inch, at Morris. The greatest daily fall at any one place was 1.52 inches on the 16th, at Rochester. The greatest snowfall was 21.5 inches, at Red Wing. At the close of the month from 6 to 12 inches of snow remained on the ground.

The water in lakes, streams, and rivers is generally low, owing to the light rainfall of the past summer and fall.

The following is from the November, 1886, report of the "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

Summary.

Mean temperature, 53°; highest temperature, 81°, on 22d, at Vicksburg; lowest temperature, 27°, on 18th, at Batesville and Oxford; monthly range of temperature, 54°; greatest daily range of temperature, 39°, at Edwards, on 1st; least daily range of temperature, 4°, at Lamar, on 22d.

Mean monthly rainfall, 4.54 inches; greatest monthly rainfall, 8.89 inches, at Memphis; least monthly rainfall, 2.54 inches, at Loch Leven; average number of days rain fell, 9.

Thunder-storms were reported as follows: Oxford, 11th, 23d; Memphis, 16th; Loch Leven, 11th; Mobile, 17th.

Fogs were reported as follows: Oxford, 10th; Starkville, 3d, 4th, 9th, 10th, 11th, 20th; Loch Leven, 4th, 8th.

Meteors were observed at Oxford on the 15th.

Ice was reported at Lamar on the 18th; Loch Leven on the 18th and 26th; first ice at Oxford on the 7th.

The observer at Lamar reports a slight snow on the 18th.

The following is an extract from the November, 1886, report of the "Missouri Weather Service," Prof. Francis E. Nipher, Washington University, Saint Louis, director:

The mean temperature for November, 1886, has been 43°.6, it being nine-tenths of a degree below the normal for November at the central station. The coldest day during the month was the 25th when the thermometer registered 21° as the lowest temperature. The temperature fell to or below 32° on nine days during the month. The highest temperature, 73°.6, was observed on the 1st.

The rainfall at the central station, 3.87 inches, was nearly one inch in excess of the normal, which is 2.95 inches. About 1.34 inches of this fell in the form of snow during the second and third decades. Between six and seven inches of snow fell during the month. The first snow of the season fell on the 5th.

In the state the lowest temperatures observed were 4°.5 at Craig, and 10° at Kirksville and Mound City. The highest temperatures were 79° at Pro Tem and 78° at Greenfield and Louisiana.

The rainfall was greatest in the southeast part of the state, being over five inches at Cairo and Ironton; in the southwest and central parts it was between two and three inches, diminishing to about one inch in the extreme northern part.

Savannah reports the past month extremely dry, with high winds and frequent changes in weather.

Lamonte reports the past month as having been remarkably mild. Pansies were blooming out of doors on the 15th. Water very scarce, it being hauled fifty and sixty miles by the Missouri Pacific Railway.

The following is from the November, 1886, report of the "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The range of temperature has been great, the highest being higher than for many Novembers past, and the lowest being lower than any since 1880. The mean temperature of the month has been slightly below the normal, and the precipitation somewhat above; almost the whole of it, however, fell in the form of snow during the severe storm of the 16th, 17th, and 18th. No such depth of snow has ever fallen in November heretofore since this service was organized.

Comparison of past Novembers.

The table shows the mean temperature, the noon temperature, and the number of days below 32° for the past nine Novembers in southeastern Nebraska; they are found by averaging the numbers reported at the different stations. It also shows the highest temperatures and the lowest recorded anywhere in the state by standard self-registering thermometers:

November.	Mean temperature.	Noon temperature.	Below 32°.	Highest temperature.	Lowest temperature.
1878.....	40.8	53.6	15.4	65.0	8.0
1879.....	38.6	46.4	15.8	66.0	7.0
1880.....	25.3	34.6	24.2	64.0	3.0
1881.....	34.2	40.6	18.2	73.8	2.0
1882.....	38.3	46.2	20.1	67.0	6.0
1883.....	37.8	46.9	21.3	69.2	1.9
1884.....	37.2	46.6	20.4	72.2	18.6
1885.....	38.1	47.2	24.3	74.5	— 5.0
1886.....	33.8	43.3			

The following table shows the precipitation, or depth in inches of rain and

melted snow or hail, the number of days on which it fell, and the number of cloudy and of clear days. Days are counted cloudy when the sky is four-fifths overcast; clear when less than one-third. The last column shows the depth of snowfall during the month:

November.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.	Snow.
	Inches.				
1878.....	0.73	1.6	3.1	16.3	.....
1879.....	2.63	4.7	6.7	14.6	.....
1880.....	0.70	4.0	4.1	15.9	3.1
1881.....	1.26	3.3	5.3	12.5	5.6
1882.....	0.82	2.8	3.1	15.7	0.6
1883.....	0.26	1.2	2.6	19.5	0.0
1884.....	0.17	2.2	5.6	10.8	0.7
1885.....	1.09	2.3	7.3	13.8	0.4
1886.....	1.26	4.5	6.8	16.2	10.5

The following is an extract from the November, 1886, report of the "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

Reports for the month were received from one hundred and forty-six observers.

The mean temperature and the precipitation of the month have been very generally above the normal. The cloudiness has also been in excess of the average.

The month was characterized by so many alterations from clear or fair to cloudy or rainy weather that it cannot be divided into less than fourteen alternating periods, although several of these are not strongly characterized by decided conditions.

Of these periods the weather conditions of New England were most affected by that covering the 17th, 18th, and 19th. The following description is given of this storm:

The 16th was followed by a sudden change, as the anticyclonic area moved away and left us under westward gradients directed to a well developed cyclonic storm central in Iowa on the morning of the 17th. Its approach was heralded by solar and lunar halos seen at many stations on the 16th; the 17th was cloudy, and rain began in the morning in Connecticut, and in the afternoon in Maine, lasting over night till the afternoon of the 18th. The rain was generally light at first, and began with northeasterly winds, suggesting the formation of a secondary low-pressure area to the south of the main storm-centre that followed the Saint Lawrence Valley; but about noon of the 18th, the clouds darkened with high, warm, southerly wind, heavy rain for an hour or two, and thunder and lightning; the latter arrived in western New England about 11 h.; in the Connecticut Valley, between 12 h. and 13 h.; in eastern Massachusetts, about 14 h.; in southwestern Maine, at 14.30; in Belfast, at 15 h. The southerly wind carried temperatures as high as 60° to 65° up to southern New Hampshire and Vermont, causing the maximum of the month at some stations; and in the shifts between this and other winds rapid changes of temperature were noted at several points. These were best determined by the self-recording thermographs at the summit and base of Blue Hill, where the coming of the warm wind was first felt on the summit, causing a strong inversion of temperatures (20° warmer at summit than base at 2.40 a. m.); this is not to be confused with inversions of temperature produced by local causes on clear, calm nights. The storm was followed by snow-squalls on the morning of the 19th, opening a period of fine weather, westerly winds, and moderate variations of temperature from the 19th to the 22d; the nights were generally frosty and were coldest on the 22d, when the pressure was highest.

The following is an extract from the November, 1886, report of the "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

The New Jersey State Weather Service has already fairly begun its work. Some forty persons throughout the different counties of the state have responded to the call issued for voluntary observers. Quite a number of these responses are from trained observers and a few are in possession of accurate and reliable meteorological records extending back a period of years. Other correspondents have called for instructions and forms with which to begin reporting, while still others are engaged in securing instruments, building shelters, and erecting observatories, preparatory to engaging in this pleasant work.

The month was slightly warmer on the whole than usual. Ploughing was going on in Middlesex county on the last day. Of the seven severe storms that passed over the country during the month of November, only four markedly influenced the weather conditions throughout New Jersey. On November 6th the area of low pressure that developed the night before in West Virginia passed northeastward through Sussex county and caused general rains—accompanied in many places by thunder and lightning—which turned into snow as the wind veered to the westward on the morning of the 7th. This was followed by a decided fall of temperature, with killing frosts. The second storm experienced was due to a low area that passed northeastward across Warren, Sussex, Passaic, and Bergen counties early on the morning of the 13th, causing in some parts of the state the heaviest downpours of the month.

The third disturbance was due to a low barometer passing over the Lakes on the 17th and 18th. The weather conditions throughout the state were much disturbed as it passed eastward to the Saint Lawrence Valley and produced high winds and copious rainfalls at all stations on those dates. Another low pressure followed the same path five days later and caused precipitation at many places on the 23d. The most destructive storm, however, that occurred during the month came from North Carolina and passed during the afternoon and evening of the 25th across the state through the counties of Cape May, Camden, Cumberland, Burlington, Gloucester, Salem, Atlantic, and Ocean.

The passage of this eastward was followed by a cold wave from the Northwest, and the lowest temperature of the month was recorded throughout the state on the morning of the 27th. The rainfall mostly occurred inside of a limit of ten days and was quite uniformly distributed, the extremes being for the month 3.37 inches at Egg Harbor City and 5.03 at Clayton. The rainfall throughout the state was above the mean as compared with valuable tables of Prof. J. C. Smock. Two cold-wave warnings were received during the month, both of which were fully justified.

The following is an extract from the November, 1886, report of the "Ohio Meteorological Bureau," Prof. B. F. Thomas, of the Ohio State University, Columbus, director:

The mean temperature was lower than that of either of the four preceding Novembers, being 38°.8. The five-year average is 40°.4, and the normal, 41°.6. The highest November maximum, 80°, was reached at Paulding on the 2d. The minimum, 11°, was not as low as usual, but the mean daily range was 1°.1 above the five-year average of 16°.8.

The mean rainfall was the greatest we have reached for November, being 4.23 inches. Our five-year average is 2.8 inches, and the normal for the state 3.26. The greater part of this rainfall occurred on the 6th, 12th, 17th, and 23d, on which dates the principal storms of the month passed over the state.

Summary.

Mean temperature, 38°.8; highest temperature, 80°.0, at Paulding, on the 2d; lowest temperature, 11°.0, at Ohio State University and Paulding, 27th and 16th; range of temperature, 69°.0; mean daily range of temperature, 17°.9; greatest daily range of temperature, 49°.0, at Paulding, on the 21st; least daily range of temperature, 3°.0, at New Alexandria, on the 23d and 30th.

Average number of clear days, 7.6; average number of fair days, 9.5; average number of cloudy days, 12.9; average number of days on which rain fell, 11.3.

Mean monthly rainfall, 4.23 inches; mean daily rainfall, 0.14 inch; greatest number of days on which rain fell, 16, at Levering and Hiram; least number of days on which rain fell, 6, at Newcomerstown; greatest rainfall, 6.73 inches, at Youngstown; least rainfall, 2.17 inches, at Pomeroy.

The following is an extract from the "Tennessee State Board of Health Bulletin" for November, 1886, prepared under the direction of J. DePlunkett, M. D., President of the State Board of Health. The weather report is prepared by H. C. Bate, Director of the State Meteorological Service:

There were no very striking features in the weather during the month of November, except the rain storms of the 17th and 21st. Except in the item of precipitation, the conditions showed but little departure from the normal.

The mean temperature was 46°.2, which was slightly below the mean of the month for the past four years. The highest temperature, 80°, was recorded on the 2d, and was 2° below the maximum of the month for 1883 and 1885, and 4° above the maximum of the month for 1884. The lowest temperature, 12°, was recorded on the 14th, and was 2° above the minimum of the month for 1883, and respectively 5° and 6° below the minimum for 1884 and 1885.

The mean depth of rainfall for the month was 6.39 inches, which was considerably above the mean for the month in the past four years, and above the normal. Of this amount the eastern division received an average of about 5.75 inches, the middle division an average of nearly 6 inches, and the western division an average of a little more than 7.50 inches. This was quite a difference in the rainfall in these two latter sections from that of the month previous, the average then being only about .50 inch. The greatest rainfall was 8.89 inches, reported at Memphis, and was the greatest November rainfall at that station during the past fifteen years, except in 1875, when the rainfall measured 9.63 inches. The rainfall at Nashville and Knoxville for the month was also above the normal, the latter being the greatest reported for November during the past fifteen years. This was doubtless the case at many stations throughout the state. The greatest local daily rainfall was 3.96 inches, reported at Covington on the 21st, on which date quite a number of stations reported heavy rains. On the 17th also there were heavy rains reported.

Summary.

Mean temperature, 46°.2; highest temperature, 80°, on the 2d, at Dyersburg and Woodstock; lowest temperature, 12°, on the 14th, at Farmingdale; range of temperature, 68°; mean monthly range of temperature, 51°.1; greatest monthly range of temperature, 60°, at Riddleton; least monthly range of temperature, 44°, at Careyville, Bolivar, and Covington; mean daily range of temperature, 18°.9; greatest daily range of temperature, 48°, on the 1st, at Hohenwald; least daily range of temperature, 1°, on the 21st, at Trenton, and on the 30th, at Riddleton; mean of maximum temperatures, 73°.3; mean of minimum temperatures, 22°.2.

Average number of clear days, 11.2; average number of fair days, 7.7;

average number of cloudy days, 11.1; average number of days on which rain or snow fell, 10.

Mean depth of rainfall, 6.39 inches; mean daily rainfall, 0.21 inches; greatest rainfall, 8.89 inches, at Memphis; least rainfall, 3.77 inches, at Waynesborough; greatest local daily rainfall, 3.96 inches, on the 21st, at Covington; days of greatest rainfall, 12th, 17th, 21st, 22d, 23d; day of greatest rainfall, 17th; days without rainfall, 14th, 19th, 28th; mean depth of snowfall, 0.03 inch.

Warmest days, 1st, 2d; coldest days, 8th, 14th.

THE EFFECT OF WIND AND EXPOSURE UPON BAROMETRIC READINGS.

The following paper was read at the recent Buffalo meeting of the American Association for the Advancement of Science by Prof. Cleveland Abbe, Assistant:

The influence of the wind on the barometer, which has been recently discussed in "Science," is a matter that has engaged the attention of several meteorologists, each apparently ignorant of what others have done in the same direction. My own attention was first called to this matter by the daily use of Robinson's and Lind's anemometers at Cincinnati in 1869, and again by phenomena attending a severe wind in Washington in 1875, after which I wrote to Prof. A. H. Mayer, of Stevens' Institute, who noticed similar phenomena. But it was not until I read, in 1877, the first paper by Hagemann on his new form of anemometer, that a suggestion arose as to the possibility of measuring and eliminating this effect. This method I have explained in two lectures on anemometry delivered in February, 1882, an abstract of which is given on page 96 of the Annual Report of the Chief Signal Officer for 1882.

The portable Lind anemometer is essentially composed of a Pitot tube in front, joined with a Hagemann anemometer or a Magius tube in the rear. These two separate instruments when thus united record only differences of pressure by measuring the height of a small column of water in the siphon tube that joins them. If now for the column of water and siphon tube, we substitute two aneroid barometers, one at the bottom of each of the vertical tubes which are now supposed to be closed below, we then have from the reading of the barometer at the bottom of the Pitot tube, whose opening faces the wind, the static barometric pressure in the free air plus the mechanical pressure caused by the wind; while from the aneroid at the bottom of the Magius tube we get the difference between the barometric pressure and the mechanical effect of the wind on the opening of that tube.

Until this or some equivalent device is made use of by meteorologists, our barometric observations must continue to be affected by a source of error that Col. Henry James has shown may be at times of more importance than any of those at present recognized.

It is only within a few days that I have seen Colonel James' memoir in the Edinburgh transactions for 1852 and, as the volume is rare, the accompanying abstract may be acceptable; I also add an abstract of a short paper by the Hon. Ralph Abercromby, published in 1875.

The problem of the meteorologist is, how to determine the elastic or static pressure existing within a mass of moving air by means of a stationary barometer. In general the pressure recorded by our mercurial barometers is affected by the wind and depends upon the following considerations:

(1.) A wind blowing across the cistern or the open leg of the siphon of a barometer out of doors, or past the open window or chimney top of the observing room, will diminish the pressure.

(2.) The aspect of the observing room and the location of the window or other aperture, such as the chimney flue, the doors, etc., the location of the window with reference to the centre or edge of the windward or leeward side of a large building, may cause either an increase or diminution of pressure.

On the leeward side of a building the relief of pressure during high winds is known to be very considerable at times. I have known of a case in Washington City where the window of a closed hall room was burst outward by the expansion of the enclosed air when a gale swept by; undoubtedly a similar relief exists on the leeward side of mountain tops. The distribution of the differences of pressure between the front and rear of thin, square, plane plates has been studied by Messrs Curtis and Burton ("Quarterly Journal of the Meteorological Society of London," vol. VIII, 1882, p. 139), whose results give us some idea of what might take place in large buildings. The diminished pressure within a closed cylinder when a current of air blows across its mouth or when it blows longitudinally past its mouth, the diminished pressure on a leeward side of a building, and that in the rear of a rapidly moving ball, are all examples of similar problems in the flow of gases past obstacles. In the case of a cannon ball the space close behind it is nearly a vacuum.

Beginning with Halley the idea has frequently been suggested that horizontal winds tend to relieve the objects beneath them from the vertical air pressure, and in this way he explains the low pressure during high hurricane winds. The only sense in which this explanation is correct is that such horizontal winds have a slight centrifugal force with respect to the earth's center and must, therefore, tend to counteract gravity, but only by an inappreciable amount. Experience shows that we can have high winds and high barometer at the same time. The low pressures ordinarily experienced, so far as they are due to the wind, are explained by the two principles that meteorology owes to Ferrel, namely the horizontal deflections due to the rotation of the earth and the circulation around a storm-centre.

Abstract of the memoir "On a necessary correction to the observed height of the barometer depending upon the force of the wind," by Capt. Henry James,

read 15th of March, 1852, from the Transactions of the Royal Society of Edinburgh, vol. XX, p. 377.

Abstract.

Capt. Henry James (afterwards Col. Sir Henry James) calls attention to the common observation of the oscillations of the mercury of the barometer during gales, and quotes the following extract from a letter received from Professor Airy: "I think, but am not certain, that the depression of the barometer at every gust of a gale of wind is an ordinary phenomenon without reference to the position of the barometer with regard to the direction of the wind. Many years ago I was in the observatory of Marseilles during the blowing of the 'Mistral,' a wind well known there, and there I saw the drop of the barometer at every gust in great perfection; I do not remember the position of the barometer." Colonel James was led to the investigation of this subject by a similar observation of a gale of wind, with the addition that the amount of the depression was in some proportion to the velocity of the wind. His isolated cottage was well situated for this investigation, and a succession of southwest gales afforded the opportunity for following up the inquiry and ascertaining the depression of the barometer corresponding to the different amounts of the pressure of the wind.

The barometer was an aneroid; the wind-gauge was a pressure anemometer of simple construction, the pressure being indicated by the compression of a spiral spring in a tube. When the wind blew with any considerable force it was found that the barometers in two sheltered positions, namely, in a cottage and in a summer house, were depressed as compared with the indications of the instrument on the open ground, and that in the two sheltered positions the depressions were in proportion to the force of the wind, and further, that every gust of wind was indicated by a corresponding depression of the barometer, while the barometer on the open ground remained stationary during all the changes in the amount of pressure of the wind, whether arising from the increased force of the gale or from the intermittent gusts.

It was therefore obvious that the cause of the depressions of the barometer was owing solely to the screened position of the instrument in the cottage and in the summer house, and that all barometers in detached houses or observatories in exposed situations must be similarly affected.

The cause of this phenomenon may be explained, he says, by the pneumatic experiments made by Hawksbee and Leslie, and by the hydrodynamic experiments of Bernoulli and Venturi.

If a window or door exposed to the wind is opened in any room in which there is a barometer, the mercury is raised, showing that the air is compressed in the room, as it is in Leslie's cylinder when we blow through the larger tube. So also the barometer is elevated by the compression of the air on the windward side of the summer house, whilst it is depressed on the leeward in proportion to the force of the wind and the intermittent gusts; but the effect in a room, the doors and windows of which are usually closed on the windward side, is to produce a depression.

"We may also infer, but I know of no experiments to support the opinion, that during gales of wind the barometer would stand at a higher level on the windward side of a hill than on the leeward, the points of observation being at the same altitude. The known discrepancies between the heights deduced from the indications of the barometer during high winds and calms are, however, most probably due to this cause."

The following table gives the depression of the barometer observed by Colonel James, with different wind-velocities. Unfortunately he makes no mention of the wind-directions and the corresponding exposure of the barometer during the observations:

Velocity in miles per hour.	Pressure in pounds per square foot.	Depression of the barometer in inches.
14.2	1	0.010
20	2	0.015
24.5	3	0.020
28.3	4	0.025
31.6	5	0.030
34.6	6	0.035
37.4	7	0.040
40.0	8	0.045

On certain small oscillations of the barometer, by Hon. Ralph Abercromby, Quarterly Journal, Meteorological Society, vol. 2, 1874-'5, p. 435.

Abstract.

Certain small oscillations in the height of the mercury in the barometer, sometimes called pumping, have been known to be associated with gusts of wind, but the precise nature of their action does not seem to be determined. In this country the oscillations rarely exceed 0.02 inch. In studying them I have found the aneroid preferable to the mercurial, owing to the absence of inertia.

The two following examples may be considered typical:

1873, Southend.—Window looking south; wind nearly south, in strong gusts. In this case the first motion of the barometer was always upwards about 0.01 inch, as if the effect of the wind, being arrested by the house, was to compress the air in the room.

1874, Brighton.—A corner house one window facing south, another facing west; wind south, strong gusts. With the west window open there was violent pumping, but in this case, the first motion was always downwards. On opening the south window as well, the pumping ceased.

RAINFALL AND ITS SOURCE IN THE SOUTHERN SLOPE.

[By Private I. M. CLINE, Signal Corps, U. S. A., Observer at Abilene, Texas.]

With the assistance of a series of observations taken under the auspices of the United States Signal Service, in that part of the southern slope which includes San Angelo and Abilene, Texas, extending through a period of ten years, I will give some deductions and advance a few views in regard to the rainfall in that section; noticing its distribution during the different months of the year and the direction of winds which favor the greatest abundance of rainfall.

It is an unquestionable fact that the annual amount of rainfall near the thirty-second parallel, after we cross the ninety-seventh meridian, decreases as we go westward, and after we cross the one hundred and second meridian the decrease is very marked and can readily be seen from casual as well as actual observation; and as we near the Rocky Mountains the precipitation is very small. The section of country of which I speak is as far west as 99° 45' west longitude, and at an elevation of from 1,700 to 1,900 feet above the sea-level; yet I am of the opinion that the rainfall of this section is sufficient for all agricultural purposes.

From a period of years we make the following deductions, giving the average rainfall in inches, tenths, and hundredths during the time named, for each month of the year: average for nine years, January, 1.02 inches; February, 1.07 inches; March, 1.46 inches; average for ten years, April, 2.16 inches; May, 3.74 inches; June, 2.79 inches; July, 3.26 inches; August, 3.40 inches; September, 4.16 inches; October, 2.94 inches; November, 1.12 inches; average for nine years, December, 2.08 inches; average annual rainfall for nine years and eight months, 29.20 inches.

From the above it is readily seen that the rainfall is over three times as much during the spring and summer months as it is during the winter months, the principal amount falling during the spring and summer, the time at which it is most needed for agricultural purposes; and in my opinion, while it is not so much rain as some eastern states have, or even the eastern part of this state, it is sufficient in quantity for any products which are adapted to this latitude, from the fact that the soil here retains moisture three times as long as the soil of states where rain is more abundant.

Out of a period extending through one hundred and sixteen months we find the prevailing direction of wind from a southerly and southeasterly quarter for seventy-six months, nearly twice as many as from all other six points of the compass together. This, in my opinion, is due to the fact that being north of the southern limit of the winds of the middle latitudes, the surface winds, on account of the rapid increase in altitude and the topography of the country, are deflected to the west; hence we get southerly and southeasterly winds instead of southwesterly winds, and it is to these southeasterly winds we are dependent for our rainfall; for, as I shall endeavor to show, the greater part of, if not all, of the moisture which reaches this section of country, is either brought from the equatorial regions or the Gulf of Mexico; the principal amount, in my opinion, reaches us from the former named source in this way: the moisture is carried up near the equator where the surface winds of the equatorial system rise to make their return through the upper strata of atmosphere, then coming down near the thirty-second parallel, still retaining in suspension a considerable amount of the moisture taken up at the equator; and this moisture is carried northward by the winds of the middle latitudes and reaches this section by means of the southerly and southeasterly winds which prevail. The moisture received from the Gulf of Mexico reaches this section by means of southeasterly winds produced by local and general atmospheric conditions different from the causes which produce the general systems of wind.

My reasons for giving the preceding as the sources of rain for this section are based on the fact that no moisture can reach this place from the Pacific Ocean, because the Rocky Mountains lie between us and that body of water, and their elevation is such that all moisture coming from that quarter is precipitated on the west side of that range of mountains, because the air in crossing them is carried to such an elevation that by expansion it is cooled down to the temperature of the dew-point, and, consequently, deposits all its moisture before it reaches the eastern side of the mountains. This is the cause of the westerly and northerly winds throughout this section being so dry; they have, in crossing the mountains referred to, been robbed of all their moisture.

It has been decided that the maximum rainfall varies in elevation depending on local influences, between an elevation of 1,900 and 5,000 feet above sea-level. Now this section is near the former elevation, with local influences which favor a good average rainfall. We have already noted the fact that the prevailing winds of this section are from a southerly and southeasterly quarter and are laden with moisture from the equatorial regions and the Gulf of Mexico, and in coming to this section they pass over sections of country of less altitude than this, and, consequently, there is nothing to deprive them of their moisture and they reach here with a sufficient quantity.

The same atmospheric conditions favor the precipitation of moisture here that they do elsewhere, and the topography of the country is very favorable, for on the western border of this section the increase in elevation is very rapid, soon reaching an altitude of between 3,000 and 4,000 feet above sea-level, which causes the moist atmosphere to be thrown up to an elevation over this section of country that will reduce it to the temperature of the dew-point, and, consequently, precipitate its moisture in some form. By the time the air comes in a few hundred miles of the Rocky Mountains it is deprived of all its moisture and goes on dry; this, in connection with the westerly and northerly winds being deprived of their moisture in coming over the mountains, causes the barren plains on the eastern Rocky Mountain slope.

[The observations, upon which the preceding is principally based, were taken

at Concho, Texas, from April, 1877, until December, 1885; since that time at Abilene, Texas.]

The following article, by Dr. H. B. Baker, Secretary of the Michigan State Board of Health, is from the "State Republican," of September 3, 1886, published in Lansing:

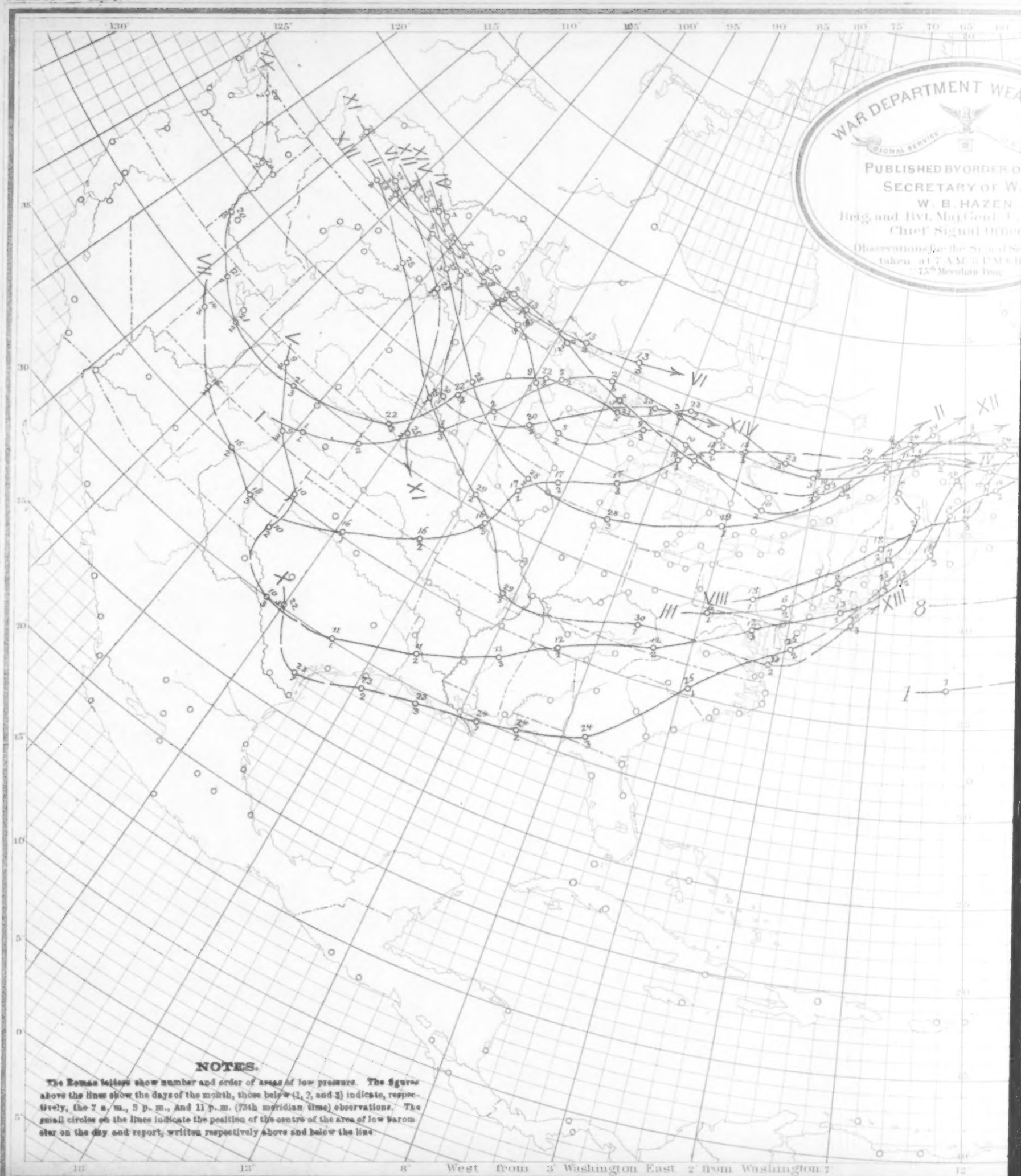
CAUSE OF PNEUMONIA.

Secretary Baker, of the State Board of Health, has devoted most of the leisure time at his disposal for months to a determined effort to trace out the cause of pneumonia, which is so prevalent in Michigan during the colder months. He has prepared diagrams and statistics based upon over 27,000 weekly reports of sickness in the state, and upon over 120,000 meteorological observations, and the conclusions arrived at point so uniformly in the same direction that Dr. Baker is confident that complete success has crowned his efforts.

"My statistics," he said to-day, "demonstrate, I think, that the sickness from pneumonia is absolutely controlled by the temperature of the atmosphere. The higher the temperature the less sickness from pneumonia, and the lower the temperature the more sickness. The fact which I think I have completely demonstrated is that in any given place, wherever studied, pneumonia is quantitatively proportionate to the coldness and dryness of the atmosphere, and it follows that if there is any pneumonia which is infectious, it is absolutely dependent upon these meteorological conditions for its action upon the human organism."

"Boiled down, my theory is as follows: Air expired from the human lungs is nearly saturated with vapor of water at a temperature of about 98°, and this contains about 18.69 grains of vapor in each cubic foot. The quantity of vapor exhaled is at all times greater than the quantity inhaled, but when the air is very cold and dry the quantity exhaled is excessive, as may be seen when we reflect that the air at 32° can contain in each cubic foot only about two grains of vapor. The fluid which passes out from the blood into the air-cells of the lungs, and which nominally keeps them moist, contains some of the salts of the blood; and the chloride of sodium not being volatile, is mostly left in the air-cells when the vapor passes out with the expired air. When the air inhaled is excessively dry, as it always is when excessively cold, this salt collects in the air-cells of the lungs in considerable proportion."

"This is proved by my statistics, which show the increase of pneumonia at such times, taken in connection with the fact that chloride of sodium in the lungs is in excess in pneumonia, which was proved in 1851 by Lionel S. Beale, M. D., of London, England. In the air cells the chlorides are irritating when they become concentrated; but the exudation of fibrine, which is the most prominent condition in pneumonia, is probably favored by a fact in osmosis which is not generally well understood, namely, that albumen, which it is usually considered will not pass by osmosis, will pass through an animal membrane to a solution of chloride of sodium. Thus the causation of pneumonia by the inhalation of cold, dry air seems to be completely worked out. It is hoped that its prevention may now begin."



Areas of Low Pressure. November, 1886.

U. S. DEPARTMENT WEATHER MAP

SIGNAL SERVICE U. S. ARMY

PUBLISHED BY ORDER OF THE
SECRETARY OF WAR.
W. B. HAZEN,
Lieut. and Bvt. Maj. Genl. U. S. Army
Chief Signal Officer.

Observations for the Signal Service are
taken at 7 A.M. 3 P.M. & 11 P.M.
75° Meridian Time

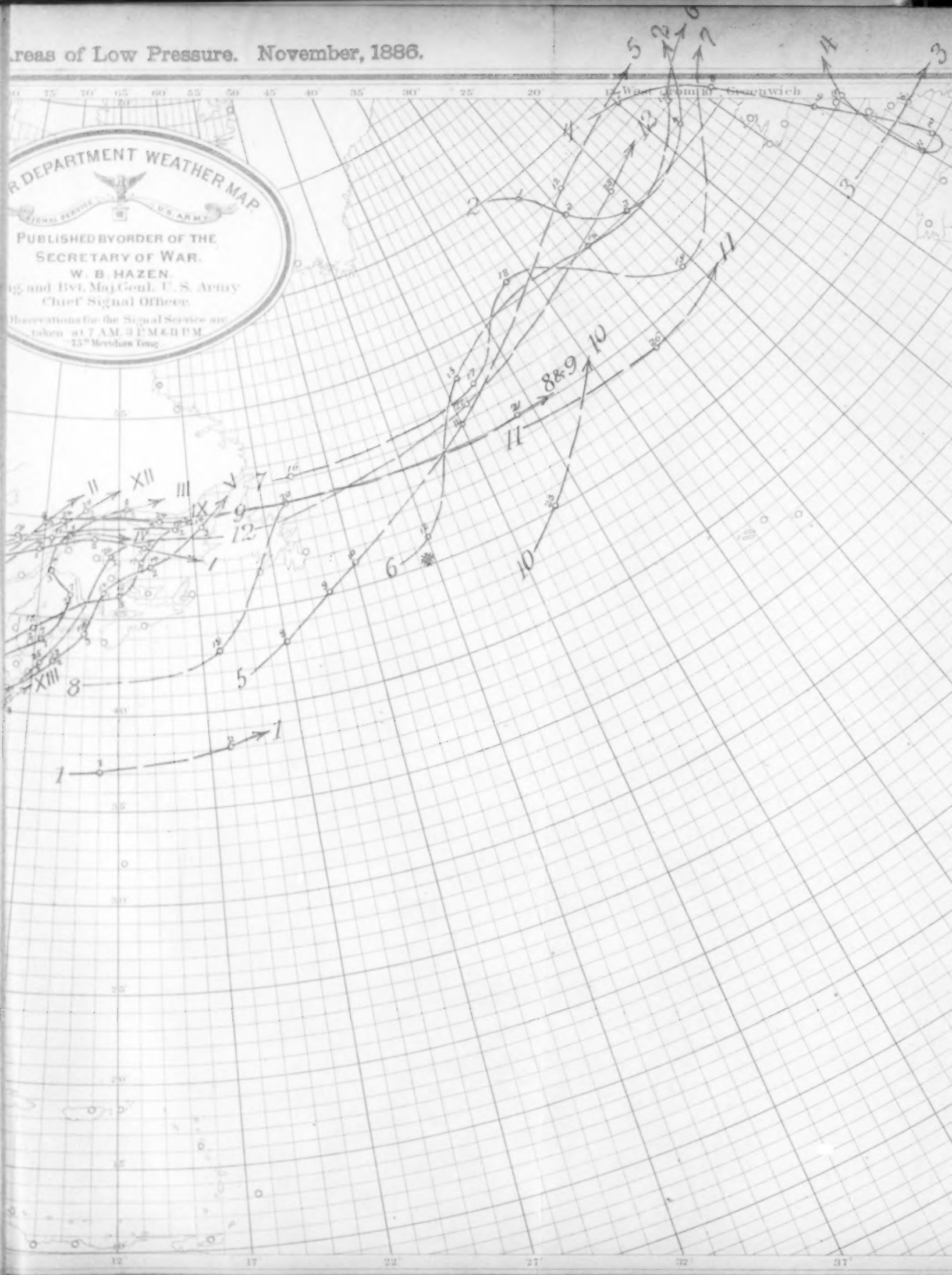


Chart II. Isobars, Isotherms, and Winds, November, 1886.

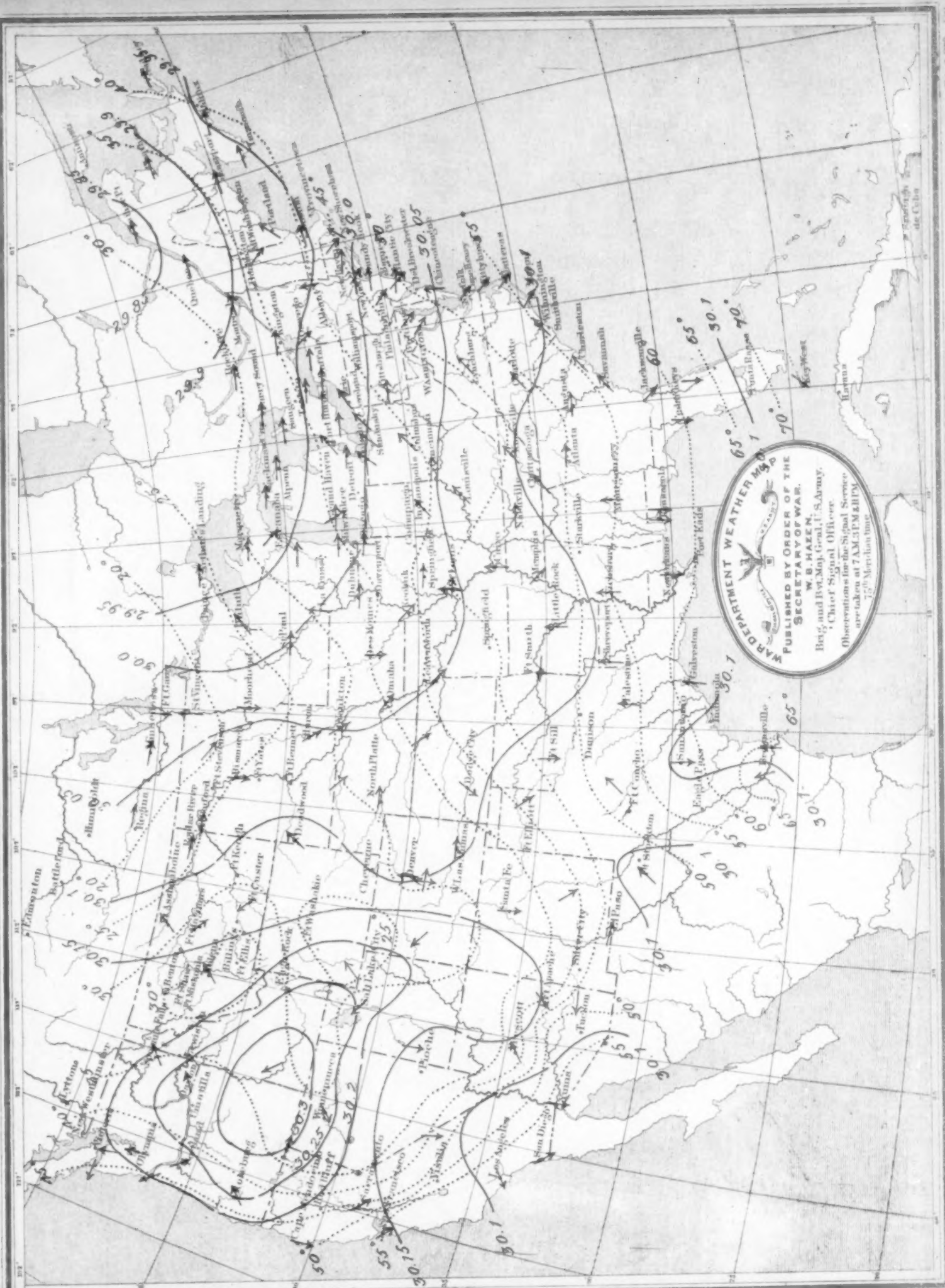


Chart III. Precipitation, November, 1886.

Form 106 F.

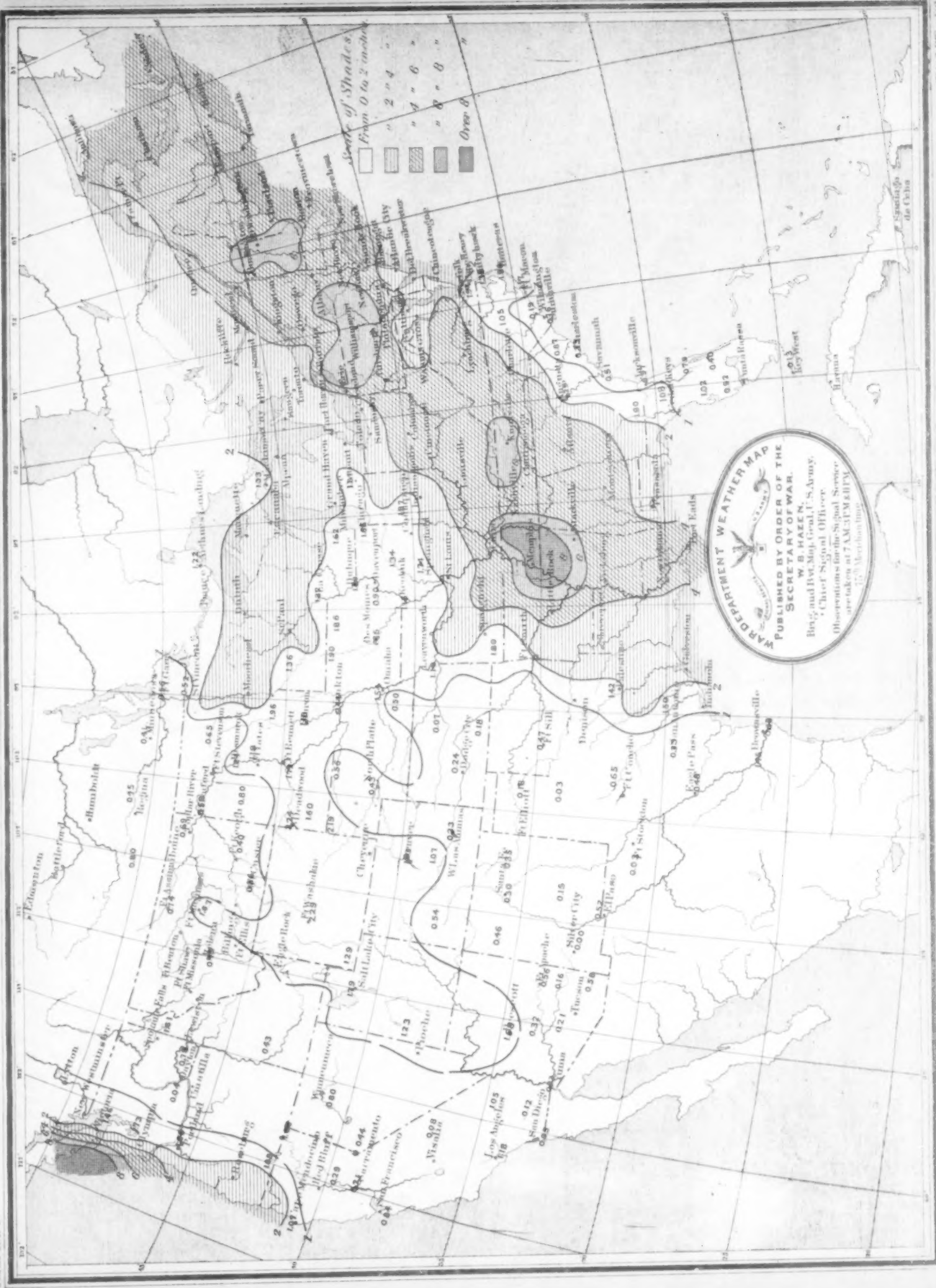


Chart IV. Departures from Normal Atmospheric Pressure and Temperature. November, 1886.

Form 104 F.

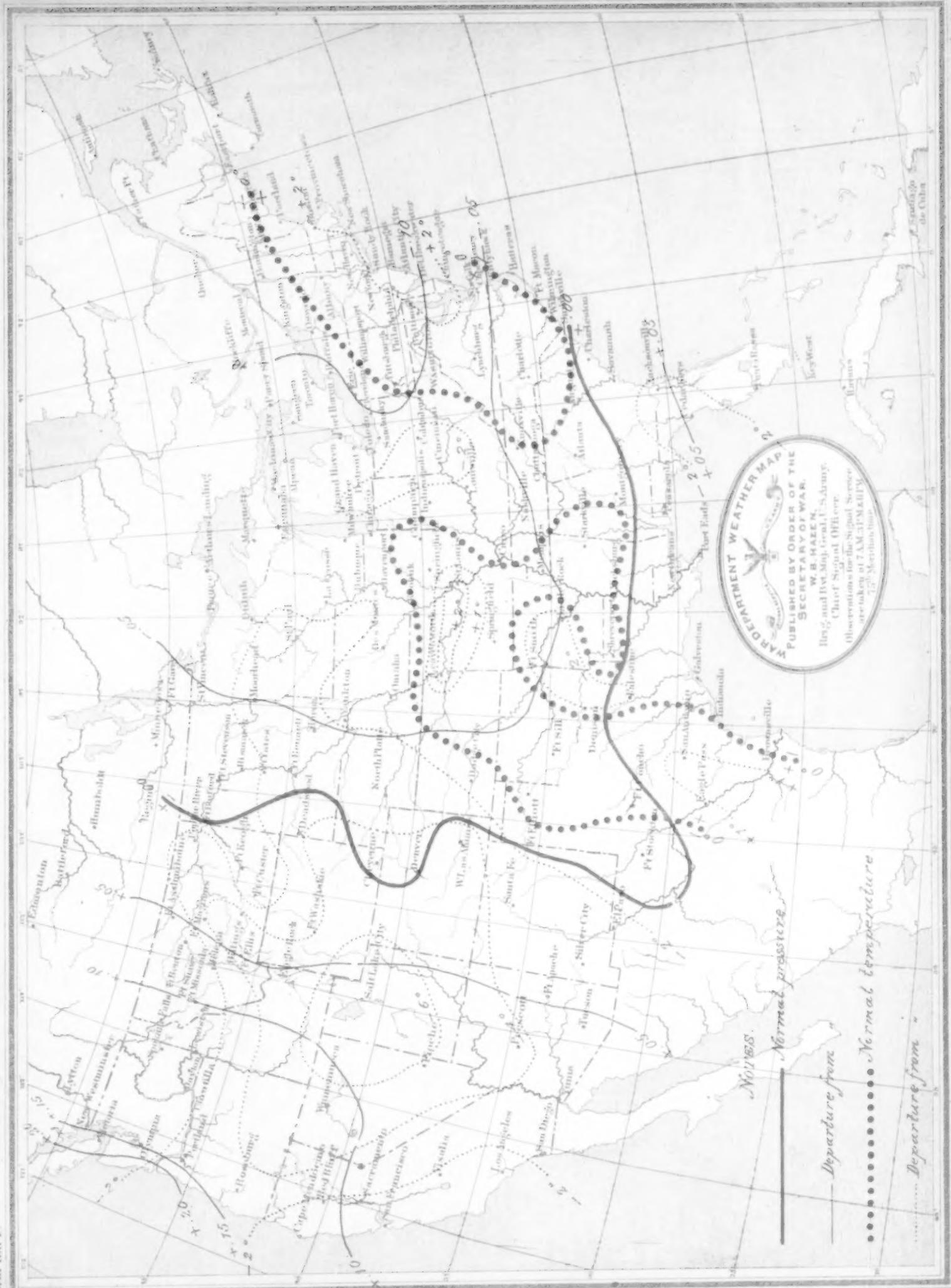
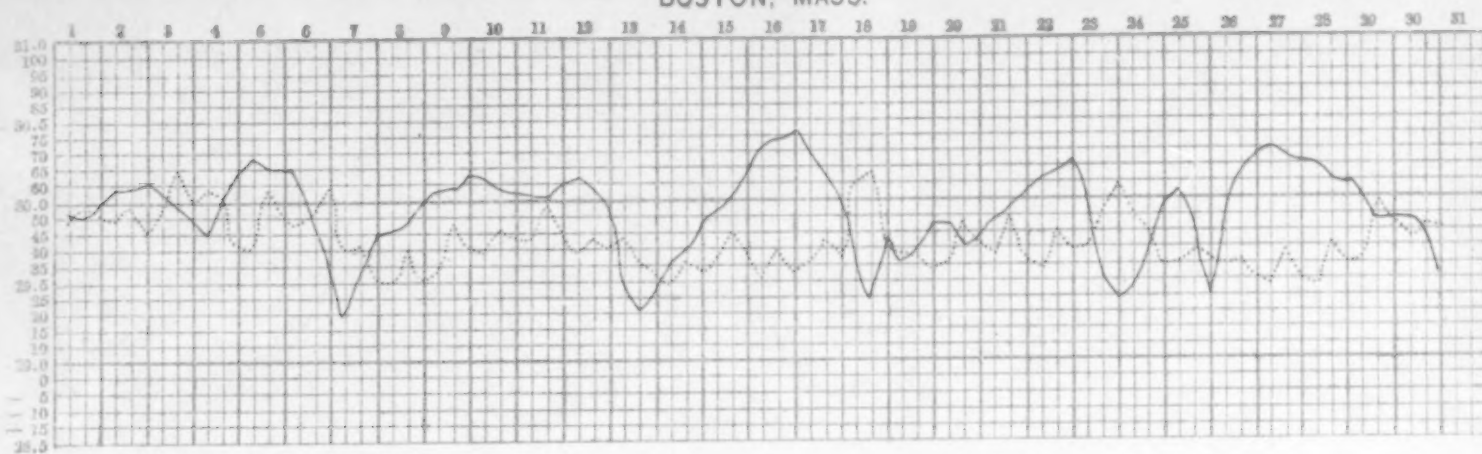
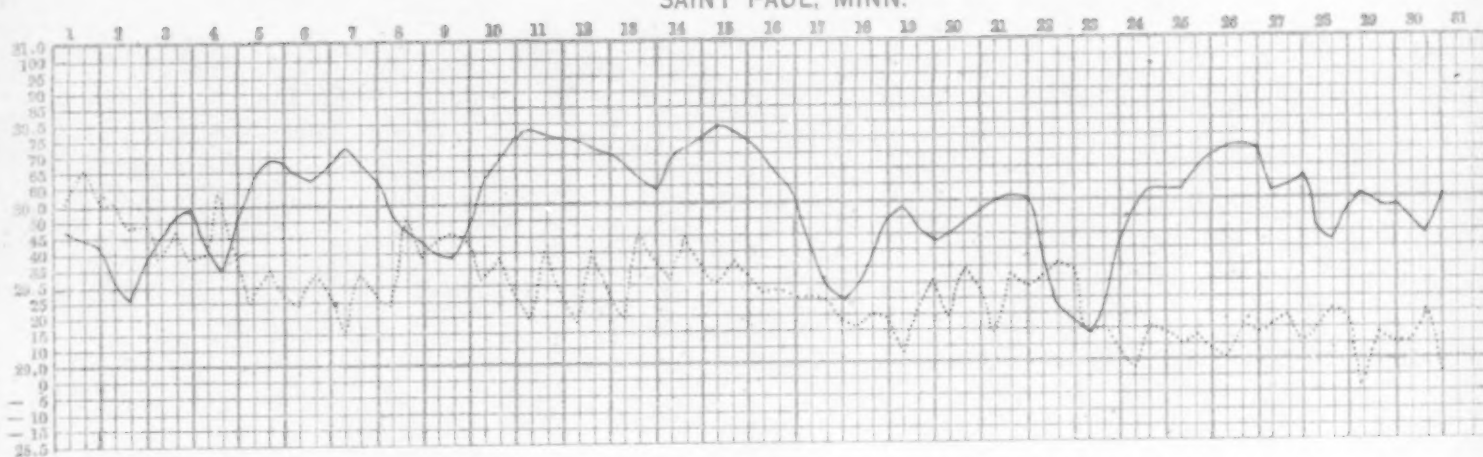


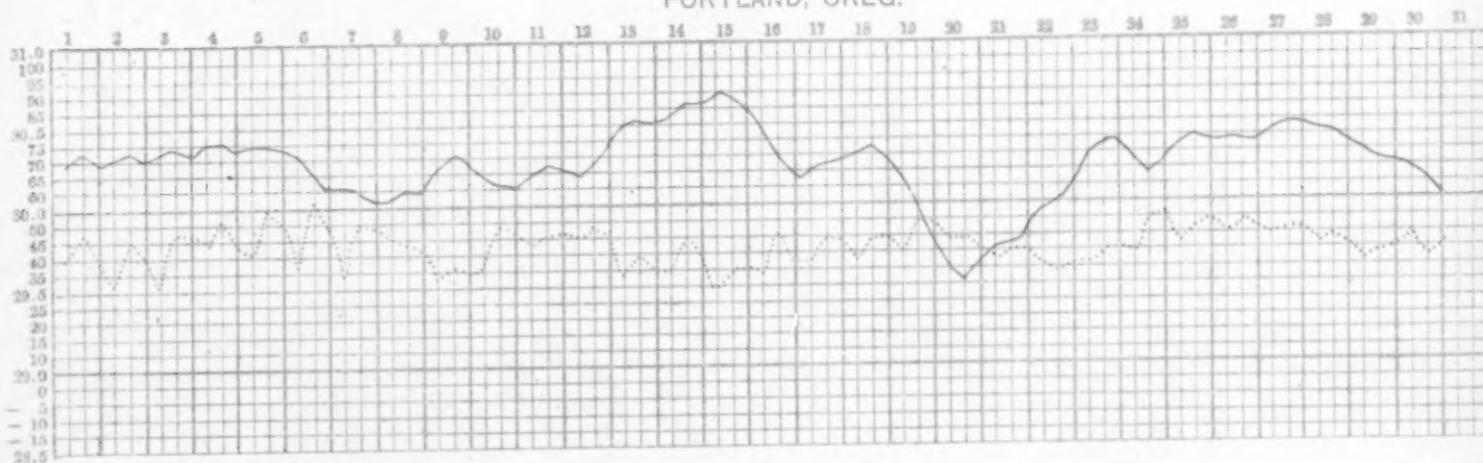
Chart V. Pressure (—) and Temperature (.....) Curves. November, 1886.
BOSTON, MASS.



SAINT PAUL, MINN.



PORTLAND, OREG.



NEW ORLEANS, LA.

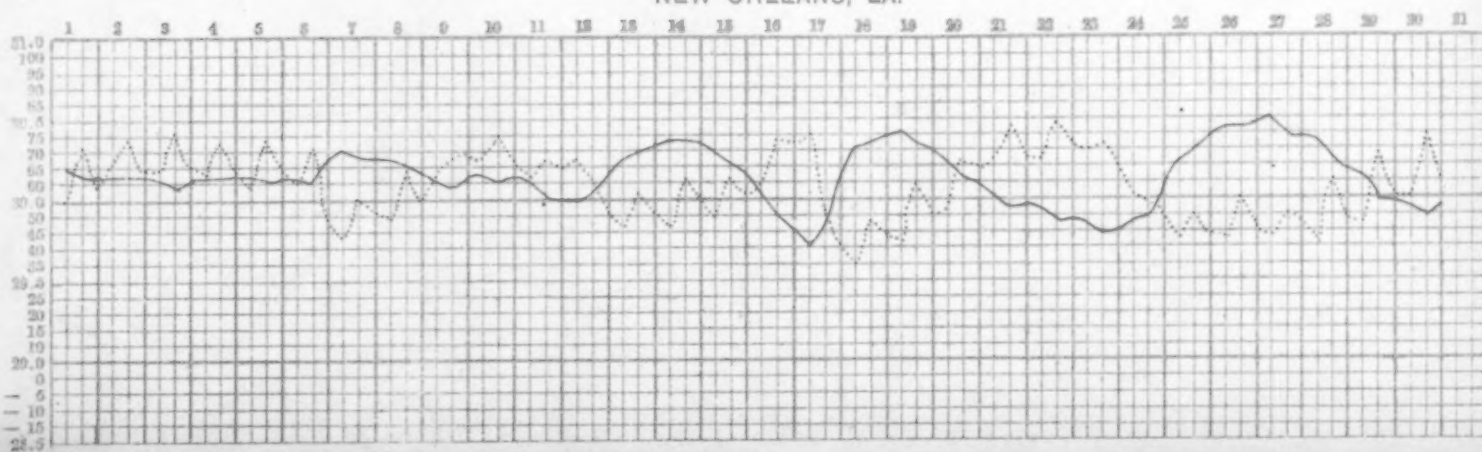
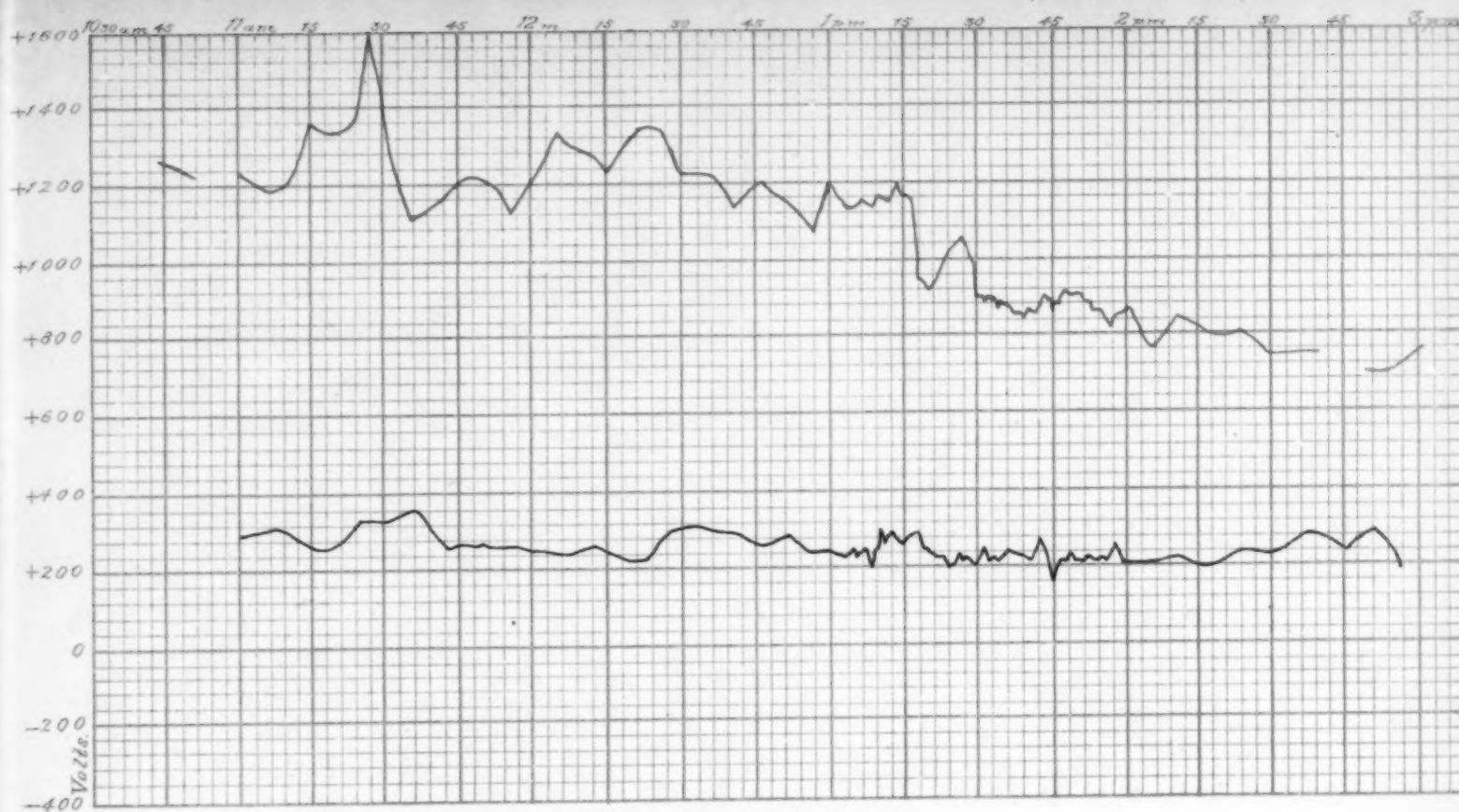
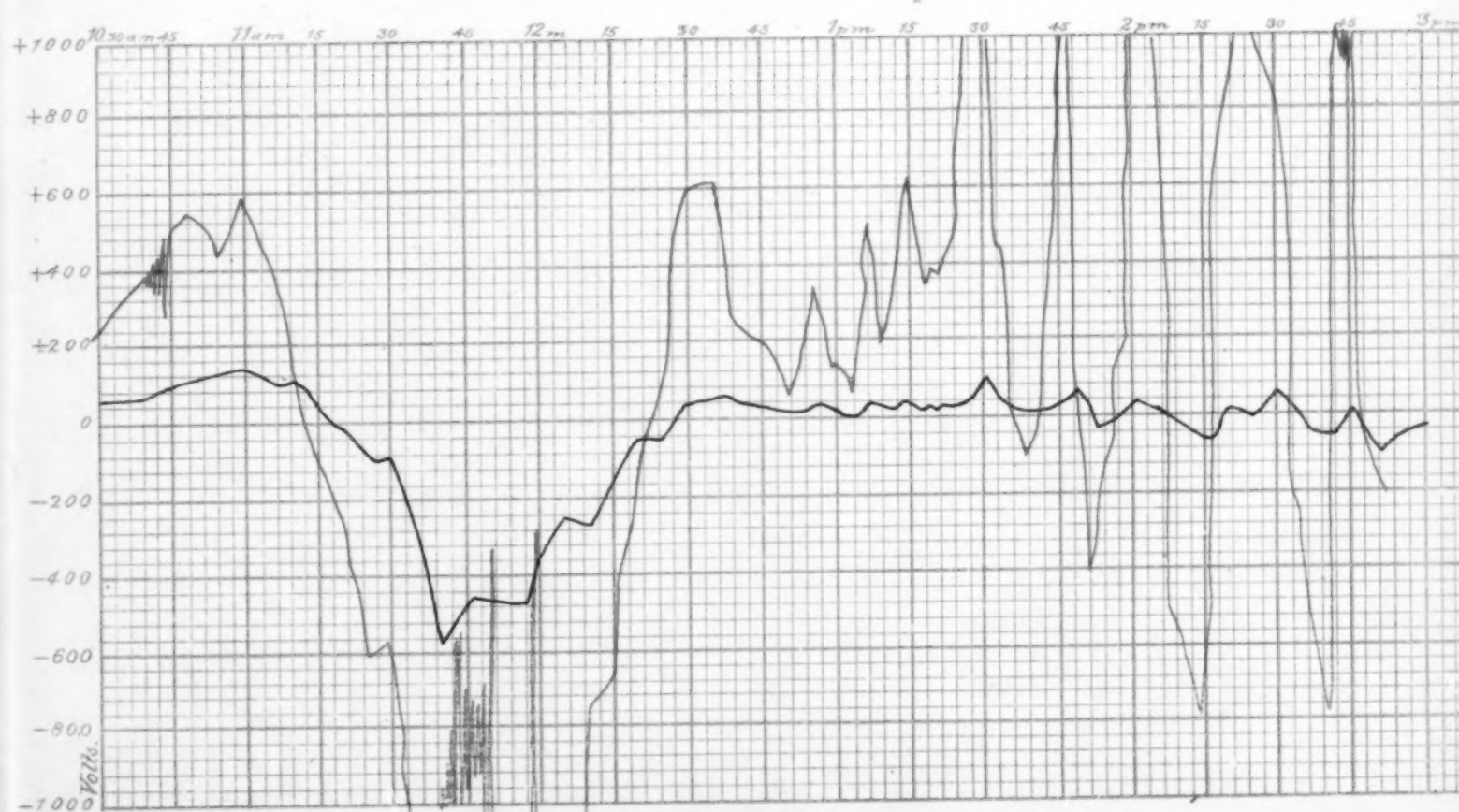


Chart VI. Curves showing Electrometer Readings.



November 3, 1886. { Monument 500 feet.
Signal Office 45 feet. —————



November 12, 1886. { Monument 500 feet.
Signal Office 45 feet. —————

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Voluntary observers of the Signal Service, on land, from whom meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for November, 1886.

Observer and place of observation.	Observer and place of observation.	Observer and place of observation.	Observer and place of observation.
Anderson, Dr. W. W., Stateburg, S. C.	Deaf Mute College, Kendall Green, D. C.	James, John W., Marengo, Ill.	Scott, Thos. G., Forsyth, Ga.
Altamir, J. M., Independence, Kans.	Dinsmore, Prof. T. H., Emporia, Kans.	Jones, Dr. E. U., Taunton, Mass.	Smith, Prof. T. B., Fayette, Mo.
Adams, Dr. O. H., Vinceland, N. J.	Dunlap, W. L., Tecumseh, Nebr.	Jackson Company, Nashua, N. H.	Stucky, Dr. C. T., Helvetia, W. Va.
Abbott, Dr. E. K., Salinas, Cal.	Dazey, J. B., Charleston, Ill.	Jordan, Dr. M. D. L., Milan, Tenn.	Slade, Elisha, Somerset, Mass.
Arents, Hiram, Oroville, Cal.	Deming, H. D., Wellsborough, Pa.	Kirkwood, E., Mauzy, Ind.	Sonedecker, Rev. T. H., Tiffin, Ohio.
Adams, A. H., Fort Meade, Fla.	Dozier, Wm., Mattoon, Ill.	Knapp, J. G., Limona, Fla.	Smith, John R., North Truro, Mass.
Avey, O. H., Oskaloosa, Iowa.	Dewhurst, Rev. E., Voluntown, Conn.	Keese, G. Pomeroy, Cooperstown, N. Y.	Sim, J. R., Summit, Va.
Beans, Thos. J., Moorestown, N. J.	Day, Theodore, Dyberry, Pa.	Kuhne, F. W., Fort Wayne, Ind.	Scribner, H. F. J., Stratford, Vt.
Bushnell, W. S., Monticello, Ind.	Dawson, Wm., Spiceland, Ind.	Ladshaw, G. E., Pacolet, S. C.	Strong, S. B., Setauket, N. Y.
Bentley, David, Princeton, Cal.	Ellsworth, W. W., Hartford, Conn.	Lueps, Miss Anna, Manitowoc, Wis.	Samostz, Oscar, Austin, Tex.
Boerner, Prof. Chas. G., Vevay, Ind.	Ellison, W. A., Statesville, N. C.	Loomis, J. C., Jeffersonville, Ind.	Smith, George F., New Midway, Md.
Blochman, L. E., Santa Maria, Cal.	Ellis, John, Marquette, Nebr.	Luther, S. M., Garrettsville, Ohio.	Standenmayer, Dr. L. R., Lincoln, N. C.
Bayerly, J. F., Spartanburg, S. C.	Ewell, Dr. M. D., South Evanston, Ill.	Loud, Prof. F. H., Colorado Springs, Colo.	Spilman, J. J., Pierce City, Mo.
Ballou, Dr. N. E., Sandwich, Ill.	Eckstein, Rev. M., Conception, Mo.	Lerch & Rice, Bethlehem, Pa.	Swezey, Prof. G. D., Crete, Nebr.
Bennett, Geo., Bandon, Oreg.	Ford, H. C., El Dorado, Kans.	Loundes, R. T., Clarksburg, W. Va.	Trembley, Dr. J. B., Oakland, Cal.
Bell, Joseph, Franklin, Pa.	Fouch, Dr. A., Anderson, Cal.	Morgan, L. Ray, Philipsburg, Pa.	Tillinghast, C. B., Albany, N. Y.
Beloit College Observatory, Beloit, Wis.	Ferris, B. F., Sunman, Ind.	Marshall, Gregory, Cresco, Iowa.	Tilford, C. M., Mount Blanco, Tex.
Baker, Dr. Henry B., Lansing, Mich.	Friend, Chas. W., Carson City, Nev.	Massachusetts Agricultural Experiment Station, Amherst, Mass.	Todd, Prof. David P., Amherst, Mass.
Beall, Dr. R. L., Lenoir, N. C.	Ferguson, Wm., Paterson, N. J.	Mt. St. Mary's College, Emmitsburg, Md.	Thornton, Prof. N., Geneseo, Ill.
Brendel, Dr. Fred., Peoria, Ill.	Ferrill, B. P., Duke, Fla.	McCready, Miss L. A., Fort Madison, Ia.	Teale, Rev. A. K., Blue Hill, Mass.
Bartlett, E. B., Vermillion, N. Y.	Fernald, Prof. M. C., Orono, Me.	McClintock, Frank, West Union, Iowa.	Truman, Geo. S., Genoa, Nebr.
Briggs, John, Albany, Oreg.	Foss, E. T., Hydesville, Cal.	McKenzie, Dr. M., Centerville, Mo.	Turnbo, Silas C., Pro Tem, Mo.
Betts, Prof. Arthur, Webster, Dak.	Fuller, Edw. N., Tacoma, Wash. T.	Moore, C. R., Bird's Nest, Va.	Terborg, Rev. J. E., Pekin, Ill.
Breed, J. E., Embarras, Wis.	Featherston, Wm., Globe, Kans.	Micklen, J. H., Variety Mills, Va.	Thompson, R. J., Tiffin, Ohio.
Baldwin, A. L., Bethel, Conn.	Field, T. G., Parkersburg, W. Va.	Macrae, Colin, Kirkwood, S. C.	Van Gleson, F. L., Upper Montclair, N. J.
Boles, Lieut. A. H., Hudson, Mich.	Gibson, J. H., Salina, Kans.	Miller, H. D., Drifton, Pa.	Vail, H. D., Santa Barbara, Cal.
Broberg, Mrs. Mary W., Manatee, Fla.	Gore, Prof. J. W., Chapel Hill, N. C.	Memminger, E. R., Flat Rock, N. C.	Voegeli, Adolphus, Des Moines, Iowa.
Black, W. H., Kalamazoo, Mich.	Gray, F. R., Yates Centre, Kans.	Moore, Nathan, Grampian Hills, Pa.	Went, E. C., Frankfort, Ky.
Blachly, C. F., Manhattan, Kans.	Gates, W. B., Burlington, Vt.	Mitchell, Dr. D. W., Harrisville, Mich.	Washburn Observatory, Madison, Wis.
Bridges, G. A., Berlin Mills, N. H.	Graves, A. B., Belleville, Kans.	Motte, L. S., West Milton, Ohio.	Wild, Rev. E. P., Newport, Vt.
Boyd, Joseph, Oskaloosa, Iowa.	Gillingham, Milnor, Fallsington, Pa.	Newcomb, G. S., Westborough, Mass.	Williams, Rev. C. F., Ashwood, Tenn.
Bowman, Peter, Ruggles, Ohio.	Gowey, H. D., North Lewisburg, Ohio.	Newell, W. C. T., Henry, Dak.	Wing, Miss M. E., Charlotte, Vt.
Calloun, P. B., Austin, Tenn.	Green, Dr. Jesse C., West Chester, Pa.	Norcom, Prof. T. J., Reidsville, N. C.	West, Silas, Cornish, Me.
Cook, S. A., Milledgeville, Ga.	Gerrish, S. H., Sacramento, Cal.	Neal, Dr. J. C., Archer Fla.	Wylie, Wm., Mount Forest, Canada.
Carrington, G. D., Brownville, Nebr.	Geddings, Dr. W. H., Alken, S. C.	Nordberg, Prof. A., Richardson, Dak.	Walt, S. E., Traverse City, Mich.
Clark, A. C., Wausau, Wis.	Gray, J. W., Stockham, Nebr.	Olds, H. D., Cedar Rapids, Iowa.	Williams College Observatory, Williamstown, Mass.
Charbonnier, Prof. L. H., Athens, Ga.	Goodwin, Wm., North Colebrook, Conn.	Oswley, Dr. J. B., Jacksonborough, O.	Wolfe, John H., Wellington, Kans.
Casey, Geo., Auburn, N. Y.	Goodspeed, Chas. W., Elyria, Ohio.	Pearce, Thomas, Eola, Oreg.	Wulfke, E. F., Independence, Iowa.
Crawford, E. A., Liberty Hill, La.	Gillingham, W., Acetotink, Va.	Partrick, J. M., North Volney, N. Y.	West, Dr. Jos., O., Princeton, Mass.
Curtiss, G. G., Fallston, Md.	Garlick, Rev. Dr. J. B., Bruntington, Va.	Purdue University, Lafayette, Ind.	Winipiseogee
Cornell University, Ithaca, N. Y.	Gray, Capt. A. W., Kenewick, Wash. T.	Peckham, Prof. W. C., Brooklyn, N. Y.	Lake Cotton
Cutting, Dr. Hiram A., Lunenburg, Vt.	Grathwohl, John, Blooming Grove, Pa.	Petterson, Dr. F., Comfort, Tex.	and Woolen
Cutter, J. L., Quilman, Ga.	Heath, E. R., Wyandotte, Kans.	Pendleton, A., Nicolaus, Cal.	Manufacturing Co.
Crosier, Adam, Laconia, Ind.	Harvard College Observatory, Cambridge, Mass.	Robins, Chas. E., Alva, Fla.	
Caulkins, John S., Thornville, Mich.	Hammitt, John W., College Hill, Ohio.	Romig, J. K., La Grande, Oreg.	
Cass, John J., Allison, Kans.	Harris, T. C., Raleigh, N. C.	Randall, E. H., Poultney, Vt.	
Cleveland, Dr. G. H., Pentwater, Mich.	Heaton, Isaac E., Fremont, Nebr.	Renfrew, H. N., Bancroft, Iowa.	
Collie, G. L., Delevan, Wis.	Hoskinson, R. M., Bainbridge Island, Wash. T.	Remington, C. V. S., Fall River, Mass.	
Cotton, Dr. D. B., Portsmouth, Ohio.	Hodge, Rev. F. B., Wilkesbarre, Pa.	Berrick, R. H., La Grange, Ind.	
Cheney, Wm., Minneapolis, Minn.	Holt, A. K., Riverside, Cal.	Robertson, T. D., Rockford, Ill.	
Carpenter, W. B., Leavenworth, Kans.	Hyde, G. A., Cleveland, Ohio.	Roberts, Luke, Clinton, Iowa.	
Carter, Rev. Dr. W. H., Tallahassee, Fla.	Haywood, John, Westerville, Ohio.	Rodman, T. R., New Bedford, Mass.	
Cummings, L. D., Palmyra, N. Y.	Hartzler, J. A., Mottville, Mich.	Runge, C., New Ulm, Tex.	
Chubb, Thos. H., Post Mills, Vt.	Hole, Joseph, Butlerville, Ind.	Richardson, C. F., Beverly, N. J.	
Cochran, Wm. P., Wakefield, Kans.	Hager, Mrs. L. G., Terre Haute, Ind.	Rotch, A. L., Blue Hill Observatory, Blue Hill, Mass.	
Culver, G. E., Vermillion, Dak.	Held, Rev. F. B., Mount Angel, Oreg.	Rathbun, J. C., Midland, Tex.	
Cole, Seward, Cahuenga, Cal.	Heatwole, L. J., Dale Enterprise, Va.	Rice, Chas. W., Yellow Springs, Ohio.	
Cutler, B. B., Heath, Mass.	Hamilton, W. H., Corsicana, Tex.	Roeder, W. F., Zionsville, Penn.	
Colton, Prof. G. H., Hiram, Ohio.	Hatch, A. H., Windsor, Ill.	Snell, S. C., Amherst, Mass.	
Chandler, Dr. W. J., South Orange, N. J.	Harris, W. C., Dover, N. J.	Stern, Jacob T., Logan, Iowa.	
Cass, W. Earle, Roseland, N. J.	Hall, J. B., Worcester, Mass.	Star, Prof. Fred'k, Cedar Rapids, Iowa.	
Chapin, Adams, Poway, Cal.	Hunter, Dr. T. C., Napoleon, Ohio.	Smith, H. D., Monticello, Iowa.	
Childs, W. H., Brattleborough, Vt.	Hall, Chas. C., Dudley, Mass.	Simmons, Prof. W. G., Wake Forest, N. C.	
Crump, M. H., Bowling Green, Ky.	Hewit, S. F. H., Middlebrook, W. Va.	Slenker, Mrs. E. D., Snowville, Va.	
Cowgill, Prof. E. B., Manhattan, Kans.	Hurlin, Rev. Wm., Antrim, N. H.	Strong, W. C., Kent's Hill, Me.	
College of the Sacred Heart, Prairie du Chien, Wisconsin.	Helm, Thos. B., Logansport, Ind.	Shaw, E., Ninescah, Kans.	
Comstock, Prof. F. M., LeRoy, N. Y.	Hazen, Rev. A., Deerfield, Mass.	Seltz, Chas., De Soto, Nebr.	
Collin, Prof. Alonzo, Mt. Vernon, Iowa.	Howe, Prof. J. L., Richmond, Ky.		
Dow, Roswell, Sycamore, Ill.	Ireland, W. H., Rappahannock, Va.		
Davis, Prof. S. M., York, Pa.			

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for November, 1886.

Alcatraz Island, Cal.	Columbus, Fort, N. Y.	Lewis, Fort, Colo.	Mount Vernon B'ks, Ala.	Snelling, Fort, Minn.	Totten, Fort, Dak.
Angel Island, Cal.	Camp Sheridan, Wyo.	Meade, Fort, Dak.	Niagara, Fort, N. Y.	Saint Augustine, Fort, Fla.	Townsend, Ft., Wash. T.
A. Lincoln, Fort, Dak.	Gaston, Fort, Cal.	McIntosh, Fort, Tex.	Nobara, Fort, Nebr.	Sisseton, Fort, Dak.	Union, Fort, N. Mex.
Bayard, Fort, New Mex.	Gibson, Fort, Ind. T.	Missoula, Fort, Mont.	Pembina, Fort, Dak.	Shaw, Fort, Mont.	Washakie, Fort, Wyo.
Benicia Barracks, Cal.	Hays, Fort, Kans.	Mason, Fort, Cal.	Randall, Fort, Dak.	Selden, Fort, Nebr.	West Point Military Academy, N. Y.
Bidwell, Fort, Cal.	Huachuca, Fort, Ariz.	McDermitt, Fort, Nev.	Robinson, Fort, Nebr.	Supply, Fort, Ind. T.	Walla Walla, Ft., Wash. T.
Brady, Fort, Mich.	Klamath, Fort, Oreg.	McDowell, Fort, Ariz.	Rego, Fort, Ind. T.	Sully, Fort, Dak.	Wingate, Fort, N. Mex.
Boise Barracks, Idaho.	Keogh, Fort, Mont.	Mojave, Fort, Ariz.	Ringgold, Fort, Tex.	Sidney, Fort, Nebr.	Yates, Fort, Dak.
Cour d'Alene, Ft., Idaho.	Lowell, Fort, Ariz.	Madison Barracks, N. Y.	Riley, Fort, Kans.	Spokane, Fort, Wash. T.	
Concho, Fort, Texas.	Laramie, Fort, Wyo.	McHenry, Fort, Md.			

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for November, 1886.

Alabama State Weather Service, under direction of P. H. Mell, Jr., Auburn, Alabama.
 Illinois Weather Service, under direction of Col. Charles F. Mills, Springfield, Illinois.
 Indiana State Weather Service, under direction of Prof. H. A. Huston, La Fayette, Indiana.
 Iowa Weather Service, under direction of Dr. Gustavus Hinrichs, Iowa City, Iowa.
 Minnesota State Weather Service, under direction of Prof. W. W. Payne, Northfield, Minnesota.
 Mississippi State Weather Service, under direction of Prof. R. B. Fulton, Oxford, Mississippi.
 Missouri State Weather Service, under direction of Prof. Francis E. Nipher, Saint Louis, Missouri.
 Nebraska Weather Service, under direction of Prof. Goodwin D. Swezey, Crete, Nebraska.
 New Jersey State Weather Service, under direction of Prof. George H. Cook, New Brunswick, N. J.
 New England Meteorological Society, Prof. Wm. H. Niles, of Boston, Mass., President; Mr. W. M. Davis, of Cambridge, Mass., Secretary.
 Ohio State Weather Service, under direction of Prof. B. F. Thomas, of the Ohio State University, Columbus, Ohio.
 Tennessee State Weather Service, under direction of H. C. Bate, Nashville, Tennessee.

PRICE-LIST OF STANDARD METEOROLOGICAL INSTRUMENTS, APPARATUS, TEXT-BOOKS, FORMS, AND PUBLICATIONS.

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do. 20 do.	26.00	do. 2.50
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Reading down to 26 inches.....	\$36.00	Packing and shipping by express, \$2.50
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do. 20 do.	26.00	do. 2.50
do. 14 do. (two verniers).....	23.00	do. 2.50
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